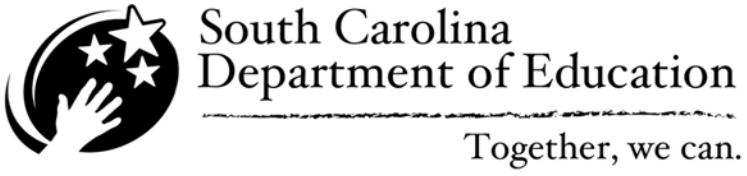
Technical Documentation for the 2009 Palmetto Assessment of State Standards of Writing, English Language Arts, Mathematics, Science, and Social Studies



Issued by the

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Office of Assessment
Division of Accountability

Jim Rex
State Superintendent of Education

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GENERAL INTRODUCTION

PALMETTO ASSESSMENT OF STATE STANDARDS

The South Carolina Palmetto Assessment of State Standards (PASS) tests are designed to measure the academic performance of charter and public school students in the content areas of writing, English language arts (ELA), mathematics, science, and social studies. The PASS replaced the Palmetto Achievement Challenge Tests (PACT), which had been used in the state since 1999. All students in grades 3 through 8 are required to take this assessment except those who qualify for the South Carolina Alternate Assessment (SC-Alt), which assesses students with significant cognitive disabilities.

In spring 2009, PASS assessments in writing, ELA, and mathematics were administered to all students in grades 3 to 8. The science and social studies tests were administered to all students in grades four and seven. In grades 3, 5, 6, and 8 students were randomly assigned to be tested in either science or social studies. The writing tests were administered over two days in March. The ELA, mathematics, science, and social studies tests were administered in May. Some operational forms had embedded field test items, and stand-alone field test forms were also administered in May 2009.

This document has two distinct parts. The first section (chapters 1 through 4) provides an introduction to the history and development of the PASS as well as the administration and scoring of the tests. The second section (chapters 5 through 9) documents the technical characteristics of test items, cut scores, reliability and standard error of measurement, and validity.

CHAPTER 1

HISTORY AND OVERVIEW

1.1 THE PALMETTO ACHIEVEMENT CHALLENGE TESTS

The Education Accountability Act (EAA) of 1998, Chapter 18 of Title 59 of the 1976 South Carolina Code of Laws, provided for the establishment of a performance-based accountability system. The State Board of Education was required to develop a statewide assessment program to measure student performance on state standards. The PACT assessment program was developed in accordance with this legislation. English language arts (ELA) and mathematics tests were administered the first time in April 1999 to all students in grades 3 through 8. In 2001 and 2002, science and social studies field tests, respectively, were added to the statewide program. In 2003, PACT included as operational tests all four subject areas – ELA, mathematics, science, social studies – for all students in grades 3-8. Effective with the 2007 administration, only students in grades 4 and 7 were administered both the science and the social studies tests. Students in grades 3, 5, 6, and 8 were randomly assigned to take either the science or the social studies test. All students in grades 3 through 8 participated in the ELA and mathematics tests. The last administration of the PACT was in spring 2008.

1.2 RECOMMENDATIONS FOR CHANGE IN THE ASSESSMENT PROGRAM

In February 2005, the South Carolina Task Force on Testing submitted recommendations for changes in the statewide assessment program to the Education Oversight Committee and the South Carolina Department of Education. Recommendations included reducing the amount of testing and providing more information on student performance to schools and teachers.

The South Carolina General Assembly also held a series of meetings during 2005 to discuss these recommendations. In March 2006, the General Assembly amended Section 59-18-320(B) of the EAA.

During his 2006 campaign for the office of State Superintendent of Education, Dr. Jim Rex promised to reform the accountability system to ensure its success. He held town hall meetings across that state. The message he heard from parents, teachers, and students was that too much time, energy, and money was spent on testing students. He also heard that the South Carolina assessments did not provide teachers with enough detailed information on how individual students are doing. Critics of PACT cited an inefficient, lengthy, and untimely data collection and reporting process.

When elected, Dr. Rex appointed a 74-member transition team to make recommendations in five areas including assessment. Members on these committees included representatives from local districts and schools, teachers, school administrator organizations, the South Carolina School Boards Association, the General Assembly, the Education Oversight Committee, the State Board of Education, business groups, and colleges and universities. As a result of the recommendations he received, Dr. Rex proposed the replacement of the PACT with end-of-

year accountability tests shaped by the No Child Left Behind Act of 2001 (NCLB) requirements. Dr. Rex also requested an accountability program that would be more transparent and understandable to parents and the general public.

1.3 THE EDUCATION ACCOUNTABILITY ACT OF 2008

On May 29, 2008, the General Assembly ratified a bill to amend the EAA. This bill revised the manner in which students, schools, and districts are assessed and how school academic performance is designated. The General Assembly noted that the PACT "no longer meets the requirements" of the amended legislation.

As stated in Section 59-18-100, the purpose of the revised EAA legislation is "to establish a performance based accountability system for public education which focuses on improving teaching and learning so that students are equipped with a strong academic foundation." The legislation in Section 59-18-100 states in part that the accountability system must:

(1) use academic achievement standards to push schools and students toward higher performance by aligning the state assessment to those standards and linking policies and criteria for performance standards, accreditation, reporting, school rewards, and targeted assistance;
(2) provide an annual report card with a performance indicator system that is logical, reasonable, fair, challenging, and technically defensible, which furnishes clear and specific information about school and district academic performance and other performance to parents and the public;
(3) require all districts to establish local accountability systems to stimulate quality teaching and learning practices and target assistance to low performing schools;
(4) provide resources to strengthen the process of teaching and learning in the classroom to improve student performance and reduce gaps in performance;
(5) support professional development as integral to improvement and to the actual work of teachers and school staff; and
(6) expand the ability to evaluate the system to conduct in-depth studies on implementation, efficiency, and the effectiveness of academic improvement efforts.

Section 59-18-310 of the EAA requires the Department of Education to develop or adopt a statewide assessment program to promote student learning and to measure student performance on state standards and:

(1) identify areas in which students, schools, or school districts need additional support;
(2) indicate the academic achievement for schools, districts, and the State;
(3) satisfy federal reporting requirements; and
(4) provide professional development to educators.

The EAA also mandated a standards-based assessment in which "an individual's performance is compared to specific performance standards and not to the performance of

other students." The new assessment must be an "objective and reliable statewide assessment" meaning that the assessment yields "consistent results" and measures "the cognitive knowledge and skills specified in the state-approved academic standards…." According to this legislation, a student's score on this assessment may not be the sole criterion for placing the student on academic probation, retaining the student in his current grade, or requiring the student to attend summer school.

In accordance with this legislation, the Palmetto Assessment of State Standards (PASS) was developed to achieve these goals. Beginning with the 2008–09 school year, PASS test results were used for school, district, and state accountability purposes.

1.4 COMPARISON OF THE PACT AND THE PASS

Although there are some similarities, PASS has specific design differences from the PACT. Like PACT, all PASS items are aligned with the South Carolina Academic Standards. Tests in both programs are untimed. A difference between the two is the administration in PASS of a separate writing test over two days in March. This change provides students with writing scores distinct from those for the remaining ELA standards. The earlier administration of the writing test assists with the SCDE's goal of providing student scores to the schools and districts in a more timely manner.

Like PACT, the PASS writing assessment contains one extended-response item for students in grades 3 through 8. While PACT included a few multiple-choice writing items, the PASS writing test contains a greater number of multiple-choice items, including items that require students to edit writing passages and stand-alone sentences. Another addition to the PASS writing assessment is the inclusion of the scoring rubric in the student's answer document. The scoring rubric, used to grade the student's composition, was updated in 2008.

The remaining four tests (English language arts, mathematics, science, and social studies) are administered during one week in May. In 2009, in addition to operational testing, PASS included one day for field tests in writing, mathematics, science, and social studies, as well as embedded field test items for writing and ELA. To reduce the number of test days in May, future PASS administrations will field test using only embedded items. As mandated by the EAA, these PASS tests do not include constructed-response items, which were a component of some PACT tests.

Another difference between PACT and PASS assessments is the discontinuation of the "read aloud" administration of the grade three tests. In addition, oral administration of ELA and the use of a calculator were allowed for students with disabilities for grades 5-8, effective 2009. In grades 3 and 4, both oral administration and calculator use remain non-standard accommodations.

1.5 GROUPS INVOLVED WITH THE PASS

The SCDE developed the PASS both directly and through private contractors. In addition, the SCDE manages the yearly administration of the PASS and disseminates the results to the schools and to the public.

Education Oversight Committee

The EOC was established through Section 56-6-10 of the South Carolina Code of Laws. According to the mandate of the Education Accountability Act of 1998, "the Education Oversight Committee . . . will review the state assessment program and the course assessments for alignment with the state standards, level of difficulty and validity, and for the ability to differentiate levels of achievement, and will make recommendations for needed changes, if any" (S.C. Code Ann. § 59-18-320(A)). The EOC is composed of eighteen members from state government, business, and education. The EOC was charged to set achievement standards for the PASS.

Technical Advisory Committee

The Technical Advisory Committee (TAC) makes recommendations to the SCDE on issues regarding field-test design, item analysis, linking issues, the item response theory (IRT) model for data analysis, procedures for standards setting and data reporting, and other relevant psychometric issues. Experts from national, state, and local organizations are included in the membership of the TAC.

Contractors and Other Groups

In addition to SCDE staff members, contractors and SC educators were involved in PASS development and administration. Pearson was contracted to develop items and test forms. Data Recognition Corporation (DRC) was contracted to provide test administration, scoring, and reporting services. MetaMetrics, Inc., provided Lexile reading measures.

1.6 SOUTH CAROLINA ACADEMIC STANDARDS AND INDICATORS

South Carolina academic standards consist of statements indicating the most important and consensually determined expectations for student learning in a particular discipline. They indicate what schools are expected to teach and what students are expected to learn. In accordance with the EAA, the purpose of academic standards is to provide the basis for the development of local curricula and statewide assessments. Further, the standards are to promote the goals of providing every student with the competencies to:

(1) read, view, and listen to complex information in the English language;
(2) write and speak effectively in the English language;
(3) solve problems by applying mathematics;
(4) conduct research and communicate findings;
(5) understand and apply scientific concepts;
(6) obtain a working knowledge of world, United States, and South Carolina history, government, economics, and geography; and

(7) use information to make decisions.

As emphasized by the Education Accountability Act (S.C. Code Ann. § 59-18), the standards

> must be reflective of the highest level of academic skills with the rigor necessary to improve the curriculum and instruction in South Carolina's schools so that students are encouraged to learn at unprecedented levels and must be reflective of the highest level of academic skills at each grade level.

The South Carolina standards also include multiple indicators for each standard. Indicators are specific statements of the cognitive processes and the content knowledge and skills that students must demonstrate in order to meet the standard. The main verb in each indicator specifies the particular aspect of the particular cognitive processes that are described in the revised Bloom's taxonomy. Use of the taxonomic verbs will allow teachers to identify the kind of knowledge addressed by an indicator and therefore enable them to teach the content in an effective manner.

The following is an example of a standard and an indicator for English language arts.

Grade 4 – Standard 1: The student will read and comprehend a variety of literary texts in print and nonprint formats.
Indicator 1.1: Analyze literary texts to draw conclusions and make inferences.

The academic standards and supporting documents are available on the South Carolina Department of Education Web site at http://www.ed.sc.gov/agency/offices/cso/standards/.

The academic standards for each subject are not presented in an instructional sequence. All of the standards and their indicators carry equal weight and should be taught in an integrated manner.

The South Carolina academic standards are reviewed on a cyclical basis using procedures agreed upon by the SCDE and the EOC. Procedures for the review of all newly revised South Carolina academic standards are published in the document *Procedures for the Cyclical Review of Current South Carolina K–12 Academic Standards and for the Development of New Academic Standards*.

The Science and Social Studies standards were reviewed, revised, and approved by the State Board of Education in 2005. They will be reviewed again in 2011. The mathematics standards were updated in 2007 and the ELA standards were reviewed and revised in 2008.

1.7 ALIGNMENT OF SOUTH CAROLINA STANDARDS WITH OTHER STANDARDS

Efforts were made to align South Carolina standards with the national standards of the National Assessment of Educational Progress (NAEP), the National Council of Teachers of Mathematics (NCTM), the National Council of Teachers of English (NCTE), and the Third International Mathematics and Science Standards (TIMSS).

More specifically, resources used by each subject are provided in the following paragraphs.

ELA and Writing

The SCDE, in consultation with Mid-continent Research for Education and Learning (McREL), developed the English language arts standards and indicators utilizing a number of resources. Important among them are the ELA standards documents of several other states as well as the national standards document *Standards for the English Language Arts,* published jointly in 1996 by the National Council of Teachers of English and the International Reading Association. The following publications and resources were also utilized:

- *Media Literacy* (a Web page written by South Carolina media consultant Frank Baker that features descriptions of and links to recommended texts and videos providing background and basic understanding of media literacy).
  http://www.frankwbaker.com/media_literacy.htm
- *Reading Framework for the 2009 National Assessment of Educational Progress* (Washington, DC: American Institutes for *Research,* 2005—prepublication edition).
  http://www.nagb.org/frameworks/fw.html
- *The State of State English Standards*, by Sandra Stotsky (Washington, DC: Thomas Fordham Foundation, 2005).
  http://www.edexcellence.net/doc/FullReport%5B01-03-05%5D.pdf
- *Report of the National Reading Panel: Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction* (Washington, DC: National Institute of Child Health and Human Development, 2000).
  http://www.nichd.nih.gov/publications/nrp/upload/report_pdf.pdf
- *Understanding University Success* (Eugene, OR: Center for Educational Policy Research, 2003).
  http://www.pewtrusts.com/pdf/education_understanding_success.pdf

Mathematics

The mathematics standards set forth in *South Carolina Mathematics Curriculum Standards 2000* were aligned with the national standards published in 2000 by the National Council of Teachers of Mathematics (NCTM) in the document *Principles and Standards for School Mathematics* (available online at http://standards.nctm.org/document/index.htm). Those national standards have also served as a guide for this 2007 edition of the South Carolina academic standards for mathematics and the supporting indicators. The academic standards documents of a number of states as well as the following publications were also utilized:

- *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (Reston, VA: NCTM, 2006).
  http://www.nctm.org/focalpoints/downloads.asp

- *Mathematics Assessment and Exercise Specifications for the National Assessment of Educational Progress*, developed by the Council of Chief State School Officers, NAEP Mathematics Consensus Project (Washington, DC: National Assessment Governing Board, U.S. Department of Education, n.d.).

- *Mathematics Framework for the 2005 National Assessment of Educational Progress,* developed by the Council of Chief State School Officers, NAEP Mathematics Project (Washington, DC: National Assessment Governing Board, U.S. Department of Education, n.d.).

Science

The SCDE, in partnership with McREL, developed the academic standards and indicators for science utilizing a number of resources. Central among these resources were the *South Carolina Science Curriculum Standards*, published by the SCDE in 2000, and the 2004 recommendations of the State Science Panel and the Education Oversight Committee (EOC) panel on science.

The *National Science Education Standards*, produced by the National Research Council and published in 1996 by the National Academy Press in Washington, DC (available at http://www.nap.edu/readingroom/books/nses/html) was the foundation of the 2000 South Carolina science standards and continues as the primary basis for the 2005 standards and the supporting indicators. The following national documents were utilized in addition:

- *Atlas of Science Literacy*, produced by Project 2061 and the National Science Teachers Association (Washington, DC: American Association for the Advancement of Science, 2001).

- *Benchmarks for Science Literacy*, produced by Project 2061 and the American Association for the Advancement of Science (New York: Oxford University Press, 1993).

- *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education*, by John S. Kendall and Robert J. Marzano. 3rd ed. (Aurora, CO: Mid-continent Regional Educational Laboratory, 2000).

- *NSTA Pathways to the Science Standards,* edited by Lawrence F. Lowery. Elementary School Edition (Arlington VA: National Science Teachers Association, 1998).

- *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice*, edited by Steven J. Rakow. Middle School Edition (Arlington, VA: National Science Teachers Association, 1998).

- *NSTA Pathways to the Science Standards*, edited by Juliana Texley and Ann Wild. High School Edition (Arlington, VA: National Science Teachers Association, 1998).

- *Science Assessment and Exercise Specifications for the National Assessment of Educational Progress*, developed by the Council of Chief State School Officers, NAEP Science Consensus Project (Washington, DC: National Assessment Governing Board, U.S. Department of Education, n.d.).

- *Science Framework for the 1996 and 2000 National Assessment of Educational Progress*, developed by the Council of Chief State School Officers with the National Center for Improving Science Education and the American Institutes for Research; edited by Mark D. Musick (Washington, DC: National Assessment Governing Board, U.S. Department of Education, 1999). http://www.nagb.org/pubs/96-2000science/toc.html.

Social Studies

The SCDE in partnership with McREL developed these social studies standards and the indicators utilizing the following sources:

- *South Carolina Social Studies Curriculum Standards,* published by the SCDE in 2000.
- The national standards documents for social studies, geography, political science, history, and economics:
- *Expectations of Excellence: Curriculum Standards for Social Studies*. Washington, DC: National Council for the Social Studies, 1994.
- *Geography for Life: National Geography Standards*. Washington, DC: National Geographic Research and Exploration, 1994.
- *National Standards for Civics and Government.* Calabasas, CA: Center for Civic Education, 1994.
- *National Standards for History.* Los Angeles, CA: National Center for History in the Schools, 1996.
- *Voluntary National Content Standards in Economics.* New York: National Council on Economic Education, 1997.
- The published social studies standards of other states, including Alabama and New York.

1.8 DATA REPORTING

The 2009 PASS student data were reported using a horizontal (within-grade) score system. Students were placed into one of three ordinal achievement level categories: Not Met, Met, and Exemplary. Students also received a scale score for each subject tested. The same scale range was used for every grade, in all subjects. Scale scores ranged from 300 to 900. The minimum scale score necessary to reach the Met achievement level was set at 600 in every case; the minimum scale score needed to reach the Exemplary level was allowed to vary among grades and subjects. The scales were constructed so that the standard deviation of scale scores was 50. In addition to the subject-total scale scores, students' performance on

every standard (or domain, for writing) was described by one of three ordinal categories: those who show weakness and a need for further instruction in the standard/domain, those who may benefit from additional activities that focus on the standard/domain, and those who show strength in the standard/domain. These categories do not correspond to the total-test performance levels of Not Met, Met, and Exemplary. See Section 7.7 for a full explanation.

CHAPTER 2

TEST DEVELOPMENT

2.1 TYPES OF ITEMS

Two types of items—multiple-choice and extended-response—were used on PASS tests. All PASS test forms for ELA, mathematics, science, and social studies contained only multiple-choice items, in numbers varying according to the blueprint specifications. The writing test forms included one extended-response and twenty-five multiple-choice items.

Multiple-Choice Items

Multiple-choice items required students to select a correct answer from several alternatives: usually four, but occasionally only three if a logical fourth alternative was not available. Three-alternative items are exceptions to the item development rules below.

Extended-Response Items

Extended-response items required students to compose a narrative in response to a writing prompt. The student response was scored on four domains: content and development, organization, voice, and conventions. Trained scorers evaluated each response against a scoring rubric which included specific indicators for each domain.

2.2 ITEM DEVELOPMENT

Pearson was contracted to develop the items for all PASS tests from 2009-2014. The SCDE's Request for Proposals (RFP) specified the following guidelines.

1. The contractor must supply items that will validly assess student achievement on the skills/knowledge defined in the standards for each assessment.
2. The items should represent the breadth of content at the grade level and should address appropriate taxonomic levels. The most recently revised standards have been developed using the revision to Bloom's taxonomy (Anderson and Krathwohl 2001). This document should be used to guide item alignment and new item development.
3. The Department shall maintain sole rights to any and all products produced under the terms of this contract.
4. In the case of all items, it will be the Contractor's responsibility to submit the following with the initial submission of items to the Department:
    a. reference sources for content passages which state the author, title of work, publisher, and year;
    b. documentation of permission to use any copyrighted material which will allow use for a minimum of ten years; and,
    c. rationales for distractors, such as statements explaining why each option is a good choice for the particular item.

5. The items must meet the following criteria established by the Department.
    a. The items will

1) be congruent with the knowledge and skills specified in the South Carolina Academic Standards;
2) represent an appropriate level of difficulty for the intended examinees;
3) require a level of reading skill appropriate to the examinees;
4) not provide clues to the answer for any other items;
5) not depend on any other items for the correct answer; and,
6) be free from bias (e.g., race, gender, ethnicity, socioeconomic status, culture, or geographic region).

b. Item stems will
1) adequately present the problem to be addressed,
2) contain only necessary information,
3) contain only positive wording (with rare exceptions), and
4) contain clear and concise wording.

c. Options will be
1) free of repetitive wording that could be placed in the stem,
2) reasonably parallel in structure and length,
3) grammatically consistent with the stem,
4) non-overlapping,
5) clearly and concisely worded,
6) free of options such as "all of the above" and "none of the above",
7) arranged in a logical order,
8) plausible,
9) free of cues that would indicate the correct answer,
10) free of absolute wording such as "always" and "never",
11) accompanied by an explanation of how each option was formulated, and
12) appropriately keyed with only one correct or best answer.

d. The graphs and illustrations will
1) depict all necessary information,
2) have all labels typeset consistent with typeface and size specified by the Department, and
3) be of professional quality.

6. Multiple-choice items will present four options.
7. The items submitted must be representative of a broad range of skills and content.
8. Multiple items may not be generated through trivial variations in wording.
9. When extended text (a passage) is used as the basis for items, the text must be substantive enough to support at least (5) items that meet quality control criteria through field-testing.

Additional item writing requirements specified that Pearson must

1. obtain and train item writers who are highly knowledgeable about the relevant content area;
2. ensure that the test items are aligned to the South Carolina Academic Standards;

3. ensure that each test item meets the item development requirements of this RFP and all item specifications;

4. ensure that each test item will, to the extent possible, be free from bias with respect to race, gender, ethnicity, socioeconomic status, culture, and geographic region; and
5. ensure that each test item and all stimulus material will, to the extent possible, be free of content that would be offensive to any cultural, religious, or ethnic group.

2.3 ITEM REVIEW REQUIREMENTS

The SCDE requires multiple reviews of the items before they are placed on an operational form. All test items are reviewed by SCDE staff, Content Review Committees, and a Sensitivity Review Committee.

Proposed reading passages for ELA and writing, accompanied by copyright information, must be submitted for SCDE review and approval prior to the development of items relating to those passages. In addition, the passages are reviewed by the Bias/Sensitivity Review Committee prior to initiation of any item development.

After developing items to meet the test specifications and RFP requirements, Pearson submitted items to SCDE staff for review. Items could be approved, rejected, or returned for a rewrite. When reviewed, all items had content/identification codes and a rationale for each incorrect option.

After initial SCDE approval of items, Pearson arranged for reviews of the items by the Content Review Committees and the Sensitivity Review Committee. Pearson was responsible for providing item notebooks for participants, conducting the meetings, and documenting all decisions, changes, and concerns during the meetings. SCDE staff and Pearson staff were present at all meetings.

Following the committee meetings, Pearson compiled committee comments and sent a documented set of items for final consideration by SCDE staff. SCDE final decisions were transmitted to Pearson, where the final changes were made.

2.4 REVIEW COMMITTEES

The SCDE convened two committees to assist in the review of test items: a content review committee (CRC) and a sensitivity review committee (SRC). CRC members are content teachers or curriculum specialists, representing each subject and grade tested. The CRC reviewed items for content, alignment to the standards, and appropriateness at the intended grade level. The SRC reviewed items for cultural, religious, or geographical bias and for content of a sensitive nature. SRC committees are made up of professionals in social service agencies and educators with expertise in guidance or counseling. The SCDE provided Pearson with recommendations for participants for both sets of committees.

A third group, known collectively as the rangefinding committees, were composed of teachers and coordinators from around the state, as selected by SCDE staff. Rangefinding committees identified sets of papers to used in the scoring of writing. These sets, known as exemplar papers, represented each possible score level at every grade. They were used in the

training and qualifying of the raters used by DRC in scoring writing extended-response items.

2.5 REVIEW PROCESS

Following Pearson's development of the items to meet the RFP requirements, the items were submitted to the SCDE staff for review. The SCDE staff focused on the alignment of the items to the academic standards, associated support documents, the range of difficulty, and the range of topics addressed in the items. Once SCDE staff approved the items for field testing, they were reviewed by the CRC and the SRC. Participants for the committees were selected by Pearson with recommendations from the SCDE.

Content Review

The participants in the CRC are content-specific teachers or curriculum specialists. The CRC is divided into subject and grade-specific groups. After a general training session, conducted by Pearson, the CRC reviewed the items appropriate to their group. A secure binder containing the items to be reviewed was provided for each committee member along with a content review checklist.

The content leader discussed the items in sets, grouped by standard or domain, using the measurement guidelines and test/item specifications. Participants voted individually to keep, revise, or reject each item. Once all votes were registered, the group leader led discussion on those items for which consensus had not been reached and recorded committee members' recommendations.

Sensitivity Review

SRC participants are made up of social service agency staff or are educators with expertise in guidance or counseling. The SRC met immediately following the CRC. Participants were provided copies of the items from the CRC (as revised) so that the most current versions of the items were utilized. Participants received a bias review checklist to use during the meeting.

Pearson staff again conducted a general training session, outlining the purpose of the meeting and discussing the review guidelines. They demonstrated the review process using a few of the test items with the committee members before asking them to review the remaining items on their own. Committee members were reminded to concentrate on bias/sensitivity rather than subject-matter content. After the committee members had completed their individual reviews, they convened to discuss any items they identified as potentially problematic. The committee reached consensus on deletion or revisions (e.g., change of context or simplification of sentence structure/language for clarity), and leaders recorded comments and recommendations through the meeting. Following the committee meetings, Pearson content specialists worked with the SCDE to revise and prepare items for field testing.

2.6 TEST SPECIFICATIONS

The South Carolina test blueprints specify the item types and the number of items for each grade level standard. The test blueprints are specific to each grade and subject. The approximate number of items tested within subject and grade level standards is published in the PASS blueprint documents. The blueprints are located on the PASS Web page under the link for the subject: http://www.ed.sc.gov/agency/Accountability/Assessment/PASS.html.

Because of embedded field test items and/or vertical linking items, the tests for 2009 contained 6 to 12 more total items than specified in the blueprint. These items were for test development and research purposes only and were not included in the calculation of student scores.

Each PASS ELA test has four standards, or content areas: literary text, information text, vocabulary, and research. Each mathematics test has five standards: number and operations, algebra, geometry, measurement, and data analysis and probability. Writing has four domains: content and development, organization, voice, and conventions. These standards/domains are assessed across all grades. For science and social studies, the number and organization of standards vary across grades. See Appendix A for a complete list.

The SCDE provided Pearson with an item specifications document in August 2008. This document specified the number of items required for each assessed indicator and the necessary number of items per test form in the SC writing, ELA, mathematics, science, and social studies academic standards. The specifications provided an acceptable range for the number of items for each indicator as well as the necessary number of items per test form for each standard. While it is acceptable for test forms to vary slightly at the indicator level, all assessments must contain the specified number of items at the standard level.

2.7 FIELD TESTING

Embedded field test items were included on the writing and ELA operational forms. Stand-alone field tests were administered to students in grades 3-8 on May 19, 2009. Multiple forms of each field test were developed for writing, mathematics, science, and social studies in each grade. The number of items per stand-alone form ranged from 24 to 40 depending upon item development needs for each subject and grade level.

2.8 ANALYSIS OF FIELD-TEST DATA

Pearson and DRC provided the SCDE with detailed item analyses of all embedded and stand-alone field test items. These analyses included classical item difficulties, item discrimination indices, the proportions of students selecting each option on multiple-choice items, option-criterion correlations, and levels of ethnic and gender differential item functioning (DIF). The statistics were reviewed by SCDE content and technical staff. Items were then accepted for PASS items banks, rejected as unsatisfactory, or set aside for possible editing and re-fieldtesting.

CHAPTER 3

TEST ADMINISTRATION

3.1 OVERVIEW

The 2009 PASS writing, ELA, mathematics, science, and social studies tests were administered to students in grades 3 through 8. Numerous DRC, state, district, and school personnel participated in the PASS administration. A hierarchical organization beginning with DRC and SCDE personnel, one district test coordinator (DTC) per district, one school test coordinator (STC) per school, and test administrators (TAs) for each classroom promoted training efficiency, facilitated test administration, and streamlined the distribution of secure materials. The use of test monitors in every classroom was recommended. DRC distributed all required testing materials to the DTCs, who in turn forwarded the materials throughout their districts.

3.2 ADMINISTRATOR TRAINING

DTCs are required to participate in pretest workshops presented by DRC and SCDE. The workshops were conducted via WebEx sessions during February (for March Writing) and March (for the May assessment). During the training sessions, DRC and SCDE staff guided the DTCs through the Test Administration Manual (TAM) and the District Test Coordinator's Supplement (SCDE 2009a, 2009b). The TAM contains, among other things, test security requirements, SCDE testing policies and procedures (including student participation guidelines, materials provided to schools, calculator and electronic devices policies, etc.) and procedures for the distribution and return of all types of test materials. DTCs must read and understand all of the policies and procedures given in the TAM and the Supplement. DTCs must provide each STC and all TAs with a TAM prior to the testing window so that they have the opportunity to become knowledgeable of all policies and procedures.

The DTCs must conduct training sessions for all STCs. Special Education Coordinators and Coordinators of programs for Limited English Proficient students are encouraged to participate in these training sessions so that they are aware of test security laws and regulation in addition to the PASS administration policies and procedures applying to all students and special procedures impacting their populations. DTCs have multiple resources available for use in their training sessions including an electronic version of the pretest workshop WebEx PowerPoint, the TAM, and the STC and TA Training Tool. DTCs and STCs are required to sign an Agreement to Maintain Test Security and Confidentiality form.

After their training, STCs hold training sessions for the TAs and the monitors. A section of the TAM is designated for the TAs (pages 43-50) and Appendix F is written especially for monitors. TAs must be certified employees of the school district or approved by the DTC. STCs may also use the TAM, the STC/TA Training Tool, or the pretest workshop PowerPoint when training the TAs and monitors. All TAs and monitors who have access to PASS secure test materials are required to read and sign the appropriate Agreement to

Maintain Test Security and Confidentiality form found in Appendix B of the TAM. The STCs train testing monitors in ways to assist the TAs and to increase test security. The STCs are also responsible for monitoring the test administration and adherence to security guidelines within their schools.

3.3 TIMELINE

All students in grades 3 through 8 took the PASS writing, ELA, and mathematics tests. All students in grades 4 and 7 took both the science and social studies tests. Students in grades 3, 5, 6, and 8 were randomly assigned to either the science or the social studies test, with approximately half of the students in each of those grades taking each test. The writing test was administered in March, while the ELA, mathematics, science, and social studies tests were administered in May. See table 3.1 for this year's specific testing schedule.

TABLE 3.1

PASS Administration Schedule, Spring 2009

Dates	Administration
March 10	Writing, Day 1 (extended-response)
March 11	Writing, Day 2 (multiple-choice)
March 12, 13, 16, 17	Make-up tests for Writing
May 12	ELA (Reading and Research)
May 13	Mathematics
May 14	Science or Social Studies
May 15	Social Studies
May 19	Field Tests (writing, mathematics, science, or social studies)
May 15, 18, 20, 21, 22	Make-up Tests

3.4 MATERIALS DISTRIBUTION AND RETURN

Test materials were sent to the DTCs in shrink-wrapped packages within boxes that included district and school inventories. All grades received non-scorable test booklets and scannable answer documents. Once the materials were accounted for and any missing materials reported to the DRC, the DTCs delivered the materials to the appropriate schools. The DRC, which was notified of any missing materials, subsequently provided procedures for documenting the discrepancies.

STCs were responsible for conducting an inventory of their test materials by comparing the ranges of security numbers on the security range sheets, which are visible through the shrinkwrap, with those listed on the security checklist and packing lists. STCs notified the DTC if any secure materials were damaged, missing, or if the school needed additional materials.

Test booklets, answer documents and other related test materials were color-coded by grade and precoded (i.e., student identification and demographic codes were printed on the materials) before delivery to the districts. Districts received extra materials for students not included in the precoding process; these materials were hand-coded at the school level. Each day of test administration, secure test materials were signed out and in using school security checklists to keep track of this exchange of materials. Materials distributed each day were limited to those needed for testing on that particular day. Secure materials were locked in storage when not in use. Once test administrations were completed, the STC collected all test materials, accounting for each on the School Security Checklist. The scorable and nonscorable documents were then packaged and locked in storage until they were shipped to DRC.

Following the return of materials, DRC generated a missing document report, listing the identification numbers of any unreturned secure materials. The report was used to notify districts of missing materials. A toll-free telephone line was manned to answer questions regarding missing documents, and follow-up procedures were employed until all materials were accounted for. Subsequently, the districts located and returned the materials or sent signed statements indicating that all secure materials had been returned.

3.5 TEST SECURITY

Test Security Laws and Regulations

Test security is an important issue before, during, and following test administration. The specific procedures used during the test administration are outlined in the TAM. Reprinted in the manual are an excerpt from Section 59-1-445 (2004) of the South Carolina Code of Laws, an excerpt from Section 59-1-447 (2004) of the Code of Laws, and the entirety of 24 S.C. Code Ann. Regs. 43-100 (Supp. 2008).

Section 59-1-445 (2004) states in part:
It is unlawful for anyone knowingly and wilfully [sic] to violate security procedures regulations promulgated by the State Board of Education for mandatory tests administered by or through the State Board of Education to students or educators, or knowingly and willfully to:

(a) Give examinees access to test questions prior to testing;
(b) Copy, reproduce, or use in any manner inconsistent with test security regulations all or any portion of any secure test booklet;
(c) Coach examinees during testing or alter or interfere with examinees' responses in any way;
(d) Make answer keys available to examinees;
(e) Fail to follow security regulations for distribution and return of secure test [materials] as directed, or fail to account for all secure test materials before, during, and after testing;
(f) Participate in, direct, aid, counsel, assist in, encourage, or fail to report any of the acts prohibited in this section.

Section 59-1-447 (2004) of the Code of Laws mandates:

Any person violating the provisions of this section or regulations issued hereunder is guilty of a misdemeanor and upon conviction must be fined not more than one thousand dollars or be imprisoned for not more than ninety days, or both. Upon conviction, the State Board of Education may suspend or revoke the administrative or teaching credentials, or both, of the person convicted.

Regulation 43-100 (Supp. 2008) mandates:
Each local school board must develop and adopt a district test security policy. The policy must provide for the security of the materials during testing and the storage of all secure tests and test materials, before, during, and after testing. Before and after testing all materials must be stored at a location(s) in the district under lock and key.

This regulation further requires:
Each District Superintendent must designate annually one individual in each district for each mandated assessment who will be the sole individual in the district authorized to procure test instruments that are utilized in testing programs administered by or through the State Board of Education.

Regulation 43-100 (Supp. 2008) also lists specific actions that are viewed as security violations that could result in criminal prosecution and/or disciplinary action to an educator's professional certificate.

Reporting Test Security Violations

All suspected test security violations, as defined in S.C. Code Ann. § 59-1-445 (2004) or 24 S.C. Code Ann. Regs. 43-100 (Supp. 2008), must be reported to the South Carolina Department of Education. Following an internal review of the circumstances and the gravity of an alleged violation, the SCDE reports the incident to the South Carolina Law Enforcement Division (SLED) in one of two ways: (1) for investigation or (2) for information. The district involved is notified by SCDE when the report is forwarded to SLED and when the SCDE receives a final report from SLED. Test security violation reports may serve as a basis for initiating the invalidation of test scores or other actions by the Certification Review committee or the State Board of Education. Procedures for reporting test security violations and more specific information are provided in the TAM.

Test Security Agreement Forms

All school and district personnel who have access to secure test materials are required to read and sign the appropriate Agreement to Maintain Test Security and Confidentiality form. The agreement forms are provided in Appendix B of the TAM. The DTC is responsible for collecting and storing the forms for three years.

Secure Materials

Secure materials include all test booklets and answer documents, all customized test booklets, Oral Administration Scripts, Audio CD-ROMS, American Sign Language DVDs,

Braille Oral Administration Scripts, rough drafts, typed responses, Braille responses, and science and social studies assignment lists. Test materials, including all test booklets, answer documents, and customized test materials, are assigned a human- and machine-readable security identification number. Secure materials are locked in storage until the day of the test administration. They are signed out on the day of testing and are signed in when returned, using the School Security Checklist. These materials are not to be left unattended at any time.

3.6 STUDENT PARTICIPATION

With few exceptions, all students in grades 3 through 8 attending South Carolina public schools are required to participate in either the PASS or the South Carolina Alternate Assessment (SC-Alt) to fulfill the mandates of federal and state law (i.e., the No Child Left Behind Act of 2001, the Individuals with Disabilities Education Act of 1997, and the South Carolina Education Accountability Act of 1998, amended in 2008). This testing requirement includes all students with IEPs or 504 Plans, suspended students, home school students who are registered through the district or local school board, homebound students, and homebased students. Also included are ESOL/LEP students, charter school students, and students who are incarcerated.

Students who are not tested include the following:

1. students who are expelled (unless the student has an IEP);
2. homebound students for whom the district has documentation indicating that the student is not physically and/or mentally able to take the tests;
3. home school students who are registered through one of the professional home school organizations; and
4. students who attend a private school.

Students with Disabilities and Students with Limited English Proficiency

Students with disabilities are included in PASS test administrations with appropriate standard and/or non-standard accommodations based upon recommendations by each student's individualized education program (IEP) committee. Students with 504 accommodation plans and limited-English-proficient (LEP) students are also included in PASS testing. (A limited number of LEP students are exempt from PASS testing. Guidelines are given in the TAM.) Some students with severe cognitive disabilities, for whom PASS testing is inappropriate, participate in the SC-Alt.

On the following pages, tables 3.2 through 3.7 present demographic summary information for those students who participated in the PASS. In these tables, rows labeled *Unknown* pertain to students on whom no data are available. For *Ethnicity*, the student databases in the schools use eleven classifications: "African American," "African American/American Indian," "American Indian," "Asian," "Hawaiian-Pacific Islander," "Hispanic," "White," "White/African American," "White/American Indian," "White/Asian," and "Other." Classifications that use the slash indicate mixed heritage. These were the only categories available for preprinting test documents with student identification and demographic codes. However, if a student did not have preprinted test documents, he or she was required to provide data by hand-coding the document being used instead. State demographic reports

condense Ethnicity into the seven categories that appear in the tables below: "White," "African American," "Hispanic," "Asian/Pacific Islander," "American Indian," "Other," and "Unknown." Asians and Hawaiian-Pacific Islanders are grouped together as "Asian/Pacific Islander." The category "Other" includes students who are of mixed race (i.e., African American/American Indian, white/African American, white/American Indian, or white/Asian) as well as students who indicated "Other" as their ethnicity.

TABLE 3.2

Grade 3: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	54,425	100.0	53,006	100.0	54,691	100.0	27,650	100.0	27,380	100.0
Gender										
Male	27,605	50.7	26,613	50.2	27,730	50.7	14,092	51.0	13,855	50.6
Female	26,795	49.2	26,361	49.7	26,926	49.2	13,536	49.0	13,511	49.3
Unknown	25	0.0	32	0.1	35	0.1	22	0.1	14	0.1
Ethnicity										
White	29,012	53.3	28,362	53.5	29,088	53.2	14,681	53.1	14,553	53.2
African American	19,602	36.0	18,949	35.7	19,704	36.0	10,021	36.2	9,860	36.0
Hispanic	3,226	5.9	3,142	5.9	3,271	6.0	1,647	6.0	1,628	5.9
Asian/Pacific Islander	724	1.3	728	1.4	748	1.4	377	1.4	373	1.4
American Indian	118	0.2	109	0.2	119	0.2	58	0.2	62	0.2
Other	1,714	3.1	1,688	3.2	1,730	3.2	846	3.1	892	3.3
Unknown	29	0.1	28	0.1	31	0.1	20	0.1	12	0.0
Lunch Program										
Free meals	27,103	49.8	25,897	48.9	27,116	49.6	13,678	49.5	13,686	50.0
Reduced meals	4,244	7.8	4,154	7.8	4,263	7.8	2,177	7.9	2,101	7.7
No F/R meals / unknown	23,078	42.4	22,955	43.3	23,312	42.6	11,795	42.7	11,593	42.3
IEP										
Yes	7,669	14.1	6,028	11.4	7,565	13.8	3,935	14.2	3,846	14.0
No or unknown	46,756	85.9	46,978	88.6	47,126	86.2	23,715	85.8	23,534	86.0
Gifted										
Academic only	4,825	8.9	4,814	9.1	4,817	8.8	2,384	8.6	2,439	8.9
Artistic only	279	0.5	277	0.5	278	0.5	125	0.5	153	0.6
Both	104	0.2	104	0.2	104	0.2	49	0.2	55	0.2
No or unknown	49,217	90.4	47,811	90.2	49,492	90.5	25,092	90.7	24,733	90.3
504 Plan										
Yes	312	0.6	304	0.6	316	0.6	172	0.6	148	0.5
No or unknown	54,113	99.4	52,702	99.4	54,375	99.4	27,478	99.4	27,232	99.5
English Proficiency										
Parent waiver	59	0.1	56	0.1	57	0.1	25	0.1	33	0.1
Pre-functional – Advanced	2,576	4.7	2,502	4.7	2,644	4.8	1,327	4.8	1,315	4.8
Initially English proficient	571	1.0	573	1.1	575	1.1	289	1.0	289	1.1
Title III exited	2	0.0	2	0.0	2	0.0	1	0.0	1	0.0
English Speaker I	24	0.0	24	0.0	24	0.0	13	0.0	11	0.0
English Speaker II	50,922	93.6	49,351	93.1	50,868	93.0	25,683	92.9	25,517	93.2
All others	271	0.5	498	0.9	521	1.0	312	1.1	214	0.8
Migrant										
Yes	33	0.1	29	0.1	33	0.1	14	0.1	20	0.1
No or unknown	54,392	99.9	52,977	99.9	54,658	99.9	27,636	99.9	27,360	99.9
Alternative School										
Yes	36	0.1	30	0.1	34	0.1	14	0.1	23	0.1
No or unknown	54,389	99.9	52,976	99.9	54,657	99.9	27,636	99.9	27,357	99.9
Customized Material										
Braille	3	0.0	1	0.0	3	0.0	2	0.0	1	0.0
Sign Language	2	0.0	4	0.0	4	0.0	3	0.0	2	0.0
Sign Language signed administration	18	0.0	0	0.0	17	0.0	11	0.0	5	0.0
Large print	42	0.1	24	0.0	20	0.0	8	0.0	8	0.0
Loose leaf	16	0.0	19	0.0	8	0.0	5	0.0	5	0.0
Form A oral administration	2,140	3.9	0	0.0	3,477	6.4	1,792	6.5	1,817	6.6
Total	2,221	4.1	48	0.1	3,529	6.5	1,821	6.6	1,838	6.7

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

TABLE 3.3

Grade 4: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	52,855	100.0	51,377	100.0	52,954	100.0	53,288	100.0	53,240	100.0
Gender										
Male	26,975	51.0	25,946	50.5	26,998	51.0	27,218	51.1	27,190	51.1
Female	25,851	48.9	25,402	49.4	25,927	49.0	26,040	48.9	26,020	48.9
Unknown	29	0.1	29	0.1	29	0.1	30	0.1	30	0.1
Ethnicity										
White	28,992	54.9	28,376	55.2	29,012	54.8	29,148	54.7	29,139	54.7
African American	18,682	35.3	17,944	34.9	18,681	35.3	18,867	35.4	18,863	35.4
Hispanic	2,839	5.4	2,750	5.4	2,877	5.4	2,884	5.4	2,860	5.4
Asian/Pacific Islander	675	1.3	672	1.3	699	1.3	699	1.3	688	1.3
American Indian	110	0.2	101	0.2	108	0.2	109	0.2	109	0.2
Other	1,531	2.9	1,500	2.9	1,543	2.9	1,546	2.9	1,546	2.9
Unknown	26	0.0	34	0.1	34	0.1	35	0.1	35	0.1
Lunch Program										
Free meals	25,623	48.5	24,394	47.5	25,530	48.2	25,796	48.4	25,769	48.4
Reduced meals	4,307	8.1	4,199	8.2	4,306	8.1	4,330	8.1	4,329	8.1
No F/R meals / unknown	22,925	43.4	22,784	44.3	23,118	43.7	23,162	43.5	23,142	43.5
IEP										
Yes	7,005	13.3	5,341	10.4	6,783	12.8	7,114	13.4	7,104	13.3
No or unknown	45,850	86.7	46,036	89.6	46,171	87.2	46,174	86.6	46,136	86.7
Gifted										
Academic only	7,342	13.9	7,320	14.2	7,326	13.8	7,328	13.8	7,326	13.8
Artistic only	743	1.4	731	1.4	745	1.4	746	1.4	745	1.4
Both	414	0.8	415	0.8	415	0.8	415	0.8	415	0.8
No or unknown	44,356	83.9	42,911	83.5	44,468	84.0	44,799	84.1	44,754	84.1
504 Plan										
Yes	443	0.8	419	0.8	445	0.8	449	0.8	450	0.8
No or unknown	52,412	99.2	50,958	99.2	52,509	99.2	52,839	99.2	52,790	99.2
English Proficiency										
Parent waiver	48	0.1	47	0.1	48	0.1	48	0.1	48	0.1
Pre-functional – Advanced	2,694	5.1	2,606	5.1	2,756	5.2	2,761	5.2	2,723	5.1
Initially English proficient	100	0.2	104	0.2	105	0.2	105	0.2	105	0.2
Title III exited	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0
English Speaker I	23	0.0	27	0.1	27	0.1	26	0.0	26	0.0
English Speaker II	49,744	94.1	48,093	93.6	49,501	93.5	49,827	93.5	49,818	93.6
All others	226	0.4	480	0.9	497	0.9	501	0.9	500	0.9
Migrant										
Yes	15	0.0	15	0.0	15	0.0	15	0.0	15	0.0
No or unknown	52,840	100.0	51,362	100.0	52,939	100.0	53,273	100.0	53,225	100.0
Alternative School										
Yes	54	0.1	50	0.1	51	0.1	58	0.1	57	0.1
No or unknown	52,801	99.9	51,327	99.9	52,903	99.9	53,230	99.9	53,183	99.9
Customized Material										
Braille	1	0.0	1	0.0	3	0.0	5	0.0	4	0.0
Sign Language	1	0.0	5	0.0	1	0.0	1	0.0	1	0.0
Sign Language signed administration	11	0.0	0	0.0	12	0.0	12	0.0	12	0.0
Large print	20	0.0	27	0.1	24	0.0	24	0.0	25	0.0
Loose leaf	12	0.0	17	0.0	12	0.0	11	0.0	11	0.0
Form A oral administration	2,284	4.3	0	0.0	3,490	6.6	3,810	7.1	3,748	7.0
Total	2,329	4.4	50	0.1	3,542	6.7	3,863	7.2	3,801	7.1

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

TABLE 3.4

Grade 5: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	52,133	100.0	52,455	100.0	52,505	100.0	26,372	100.0	26,219	100.0
Gender										
Male	26,668	51.2	26,877	51.2	26,899	51.2	13,492	51.2	13,455	51.3
Female	25,442	48.8	25,544	48.7	25,572	48.7	12,864	48.8	12,746	48.6
Unknown	23	0.0	34	0.1	34	0.1	16	0.1	18	0.1
Ethnicity										
White	28,547	54.8	28,680	54.7	28,684	54.6	14,345	54.4	14,366	54.8
African American	18,762	36.0	18,940	36.1	18,937	36.1	9,513	36.1	9,484	36.2
Hispanic	2,766	5.3	2,769	5.3	2,804	5.3	1,463	5.5	1,338	5.1
Asian/Pacific Islander	610	1.2	602	1.1	611	1.2	301	1.1	308	1.2
American Indian	118	0.2	118	0.2	118	0.2	52	0.2	67	0.3
Other	1,310	2.5	1,310	2.5	1,315	2.5	681	2.6	637	2.4
Unknown	20	0.0	36	0.1	36	0.1	17	0.1	19	0.1
Lunch Program										
Free meals	24,848	47.7	24,927	47.5	24,951	47.5	12,610	47.8	12,395	47.3
Reduced meals	4,343	8.3	4,362	8.3	4,364	8.3	2,114	8.0	2,260	8.6
No F/R meals / unknown	22,942	44.0	23,166	44.2	23,190	44.2	11,648	44.2	11,564	44.1
IEP										
Yes	6,840	13.1	6,986	13.3	6,980	13.3	3,494	13.2	3,507	13.4
No or unknown	45,293	86.9	45,469	86.7	45,525	86.7	22,878	86.8	22,712	86.6
Gifted										
Academic only	8,288	15.9	8,285	15.8	8,285	15.8	4,080	15.5	4,214	16.1
Artistic only	917	1.8	914	1.7	914	1.7	457	1.7	458	1.7
Both	568	1.1	570	1.1	570	1.1	296	1.1	274	1.0
No or unknown	42,360	81.3	42,686	81.4	42,736	81.4	21,539	81.7	21,273	81.1
504 Plan										
Yes	490	0.9	494	0.9	494	0.9	243	0.9	252	1.0
No or unknown	51,643	99.1	51,961	99.1	52,011	99.1	26,129	99.1	25,967	99.0
English Proficiency										
Parent waiver	67	0.1	67	0.1	67	0.1	33	0.1	35	0.1
Pre-functional – Advanced	2,360	4.5	2,352	4.5	2,404	4.6	1,235	4.7	1,161	4.4
Initially English proficient	174	0.3	172	0.3	172	0.3	103	0.4	70	0.3
Title III exited	42	0.1	42	0.1	42	0.1	26	0.1	16	0.1
English Speaker I	64	0.1	65	0.1	65	0.1	33	0.1	32	0.1
English Speaker II	49,202	94.4	49,296	94.0	49,290	93.9	24,699	93.7	24,675	94.1
All others	224	0.4	461	0.9	465	0.9	243	0.9	230	0.9
Migrant										
Yes	28	0.1	30	0.1	30	0.1	21	0.1	10	0.0
No or unknown	52,105	99.9	52,425	99.9	52,475	99.9	26,351	99.9	26,209	100.0
Alternative School										
Yes	73	0.1	78	0.1	76	0.1	37	0.1	39	0.1
No or unknown	52,060	99.9	52,377	99.9	52,429	99.9	26,335	99.9	26,180	99.9
Customized Material										
Braille	2	0.0	5	0.0	4	0.0	4	0.0	1	0.0
Sign Language	3	0.0	11	0.0	2	0.0	1	0.0	1	0.0
Sign Language signed administration	17	0.0	10	0.0	20	0.0	10	0.0	9	0.0
Large print	18	0.0	18	0.0	15	0.0	4	0.0	11	0.0
Loose leaf	21	0.0	19	0.0	9	0.0	5	0.0	5	0.0
Form A oral administration	2,335	4.5	2,182	4.2	3,926	7.5	1,872	7.1	1,957	7.5
Total	2,396	4.6	2,245	4.3	3,976	7.6	1,896	7.2	1,984	7.6

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

TABLE 3.5

Grade 6: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	51,543	100.0	51,859	100.0	51,910	100.0	26,038	100.0	25,971	100.0
Gender										
Male	26,476	51.4	26,694	51.5	26,722	51.5	13,419	51.5	13,364	51.5
Female	25,019	48.5	25,105	48.4	25,128	48.4	12,591	48.4	12,574	48.4
Unknown	48	0.1	60	0.1	60	0.1	28	0.1	33	0.1
Ethnicity										
White	28,214	54.7	28,393	54.8	28,393	54.7	14,301	54.9	14,127	54.4
African American	18,776	36.4	18,873	36.4	18,880	36.4	9,434	36.2	9,507	36.6
Hispanic	2,540	4.9	2,551	4.9	2,578	5.0	1,291	5.0	1,283	4.9
Asian/Pacific Islander	629	1.2	628	1.2	642	1.2	305	1.2	337	1.3
American Indian	107	0.2	110	0.2	110	0.2	58	0.2	52	0.2
Other	1,228	2.4	1,241	2.4	1,244	2.4	616	2.4	634	2.4
Unknown	49	0.1	63	0.1	63	0.1	33	0.1	31	0.1
Lunch Program										
Free meals	23,873	46.3	23,948	46.2	23,968	46.2	12,116	46.5	11,909	45.9
Reduced meals	4,184	8.1	4,192	8.1	4,195	8.1	2,011	7.7	2,193	8.4
No F/R meals / unknown	23,486	45.6	23,719	45.7	23,747	45.7	11,911	45.7	11,869	45.7
IEP										
Yes	6,211	12.1	6,406	12.4	6,405	12.3	3,220	12.4	3,217	12.4
No or unknown	45,332	87.9	45,453	87.6	45,505	87.7	22,818	87.6	22,754	87.6
Gifted										
Academic only	8,363	16.2	8,358	16.1	8,360	16.1	4,165	16.0	4,201	16.2
Artistic only	632	1.2	635	1.2	635	1.2	303	1.2	333	1.3
Both	470	0.9	469	0.9	469	0.9	221	0.8	248	1.0
No or unknown	42,078	81.6	42,397	81.8	42,446	81.8	21,349	82.0	21,189	81.6
504 Plan										
Yes	616	1.2	615	1.2	613	1.2	319	1.2	295	1.1
No or unknown	50,927	98.8	51,244	98.8	51,297	98.8	25,719	98.8	25,676	98.9
English Proficiency										
Parent waiver	85	0.2	85	0.2	85	0.2	46	0.2	39	0.2
Pre-functional – Advanced	2,009	3.9	2,011	3.9	2,059	4.0	1,040	4.0	1,007	3.9
Initially English proficient	241	0.5	245	0.5	245	0.5	103	0.4	142	0.5
Title III exited	71	0.1	71	0.1	71	0.1	41	0.2	30	0.1
English Speaker I	62	0.1	64	0.1	64	0.1	25	0.1	39	0.2
English Speaker II	48,811	94.7	48,914	94.3	48,918	94.2	24,518	94.2	24,487	94.3
All others	264	0.5	469	0.9	468	0.9	265	1.0	227	0.9
Migrant										
Yes	38	0.1	38	0.1	38	0.1	20	0.1	18	0.1
No or unknown	51,505	99.9	51,821	99.9	51,872	99.9	26,018	99.9	25,953	99.9
Alternative School										
Yes	365	0.7	351	0.7	353	0.7	170	0.7	184	0.7
No or unknown	51,178	99.3	51,508	99.3	51,557	99.3	25,868	99.3	25,787	99.3
Customized Material										
Braille	10	0.0	8	0.0	7	0.0	4	0.0	4	0.0
Sign Language	0	0.0	1	0.0	4	0.0	1	0.0	2	0.0
Sign Language signed administration	16	0.0	19	0.0	18	0.0	10	0.0	8	0.0
Large print	13	0.0	14	0.0	13	0.0	9	0.0	6	0.0
Loose leaf	19	0.0	16	0.0	15	0.0	4	0.0	9	0.0
Form A oral administration	2,294	4.5	2,394	4.6	3,458	6.7	1,680	6.5	1,751	6.7
Total	2,352	4.6	2,452	4.7	3,515	6.8	1,708	6.6	1,780	6.9

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

TABLE 3.6

Grade 7: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	51,440	100.0	51,680	100.0	51,735	100.0	51,703	100.0	51,633	100.0
Gender										
Male	26,381	51.3	26,552	51.4	26,575	51.4	26,543	51.3	26,508	51.3
Female	25,020	48.6	25,056	48.5	25,091	48.5	25,091	48.5	25,058	48.5
Unknown	39	0.1	72	0.1	69	0.1	69	0.1	67	0.1
Ethnicity										
White	28,637	55.7	28,751	55.6	28,749	55.6	28,743	55.6	28,727	55.6
African American	18,596	36.2	18,678	36.1	18,679	36.1	18,657	36.1	18,639	36.1
Hispanic	2,429	4.7	2,432	4.7	2,475	4.8	2,474	4.8	2,449	4.7
Asian/Pacific Islander	607	1.2	611	1.2	625	1.2	624	1.2	615	1.2
American Indian	113	0.2	112	0.2	112	0.2	112	0.2	112	0.2
Other	1,025	2.0	1,020	2.0	1,022	2.0	1,020	2.0	1,020	2.0
Unknown	33	0.1	76	0.1	73	0.1	73	0.1	71	0.1
Lunch Program										
Free meals	22,864	44.4	22,876	44.3	22,912	44.3	22,889	44.3	22,844	44.2
Reduced meals	4,252	8.3	4,240	8.2	4,239	8.2	4,238	8.2	4,236	8.2
No F/R meals / unknown	24,324	47.3	24,564	47.5	24,584	47.5	24,576	47.5	24,553	47.6
IEP										
Yes	6,183	12.0	6,375	12.3	6,371	12.3	6,356	12.3	6,351	12.3
No or unknown	45,257	88.0	45,305	87.7	45,364	87.7	45,347	87.7	45,282	87.7
Gifted										
Academic only	9,468	18.4	9,444	18.3	9,442	18.3	9,443	18.3	9,439	18.3
Artistic only	706	1.4	707	1.4	707	1.4	707	1.4	706	1.4
Both	648	1.3	650	1.3	650	1.3	650	1.3	650	1.3
No or unknown	40,618	79.0	40,879	79.1	40,936	79.1	40,903	79.1	40,838	79.1
504 Plan										
Yes	616	1.2	615	1.2	615	1.2	612	1.2	612	1.2
No or unknown	50,824	98.8	51,065	98.8	51,120	98.8	51,091	98.8	51,021	98.8
English Proficiency										
Parent waiver	68	0.1	67	0.1	67	0.1	67	0.1	67	0.1
Pre-functional – Advanced	1,865	3.6	1,854	3.6	1,914	3.7	1,911	3.7	1,876	3.6
Initially English proficient	79	0.2	76	0.1	76	0.1	76	0.1	76	0.1
Title III exited	66	0.1	66	0.1	66	0.1	66	0.1	66	0.1
English Speaker I	122	0.2	124	0.2	124	0.2	124	0.2	124	0.2
English Speaker II	48,901	95.1	48,962	94.7	48,957	94.6	48,930	94.6	48,899	94.7
All others	339	0.7	531	1.0	531	1.0	529	1.0	525	1.0
Migrant										
Yes	15	0.0	15	0.0	15	0.0	15	0.0	15	0.0
No or unknown	51,425	100.0	51,665	100.0	51,720	100.0	51,688	100.0	51,618	100.0
Alternative School										
Yes	664	1.3	631	1.2	632	1.2	626	1.2	624	1.2
No or unknown	50,776	98.7	51,049	98.8	51,103	98.8	51,077	98.8	51,009	98.8
Customized Material										
Braille	1	0.0	3	0.0	3	0.0	3	0.0	3	0.0
Sign Language	1	0.0	3	0.0	1	0.0	0	0.0	4	0.0
Sign Language signed administration	19	0.0	22	0.0	24	0.0	25	0.0	21	0.0
Large print	16	0.0	16	0.0	16	0.0	18	0.0	18	0.0
Loose leaf	19	0.0	15	0.0	12	0.0	10	0.0	11	0.0
Form A oral administration	2,431	4.7	2,448	4.7	3,195	6.2	3,226	6.2	3,190	6.2
Total	2,487	4.8	2,507	4.9	3,251	6.3	3,282	6.3	3,247	6.3

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

TABLE 3.7

Grade 8: Summary of Student Demographics

Demographics	Writing		ELA		Mathematics		Science		Social Studies	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
All Students	51,847	100.0	52,000	100.0	52,069	100.0	26,137	100.0	26,027	100.0
Gender										
Male	26,539	51.2	26,649	51.2	26,679	51.2	13,539	51.8	13,191	50.7
Female	25,247	48.7	25,298	48.7	25,337	48.7	12,573	48.1	12,803	49.2
Unknown	61	0.1	53	0.1	53	0.1	25	0.1	33	0.1
Ethnicity										
White	28,208	54.4	28,312	54.4	28,318	54.4	14,136	54.1	14,214	54.6
African American	19,473	37.6	19,516	37.5	19,523	37.5	9,840	37.6	9,740	37.4
Hispanic	2,415	4.7	2,426	4.7	2,463	4.7	1,263	4.8	1,195	4.6
Asian/Pacific Islander	633	1.2	630	1.2	641	1.2	323	1.2	318	1.2
American Indian	132	0.3	134	0.3	134	0.3	68	0.3	66	0.3
Other	925	1.8	929	1.8	937	1.8	480	1.8	464	1.8
Unknown	61	0.1	53	0.1	53	0.1	27	0.1	30	0.1
Lunch Program										
Free meals	22,896	44.2	22,903	44.0	22,951	44.1	11,559	44.2	11,435	43.9
Reduced meals	4,155	8.0	4,151	8.0	4,155	8.0	2,054	7.9	2,106	8.1
No F/R meals / unknown	24,796	47.8	24,946	48.0	24,963	47.9	12,524	47.9	12,486	48.0
IEP										
Yes	6,383	12.3	6,571	12.6	6,577	12.6	3,341	12.8	3,254	12.5
No or unknown	45,464	87.7	45,429	87.4	45,492	87.4	22,796	87.2	22,773	87.5
Gifted										
Academic only	9,642	18.6	9,630	18.5	9,631	18.5	4,770	18.2	4,866	18.7
Artistic only	778	1.5	777	1.5	777	1.5	386	1.5	391	1.5
Both	649	1.3	650	1.3	650	1.2	311	1.2	340	1.3
No or unknown	40,778	78.7	40,943	78.7	41,011	78.8	20,670	79.1	20,430	78.5
504 Plan										
Yes	642	1.2	639	1.2	639	1.2	295	1.1	344	1.3
No or unknown	51,205	98.8	51,361	98.8	51,430	98.8	25,842	98.9	25,683	98.7
English Proficiency										
Parent waiver	90	0.2	92	0.2	92	0.2	40	0.2	52	0.2
Pre-functional – Advanced	1,675	3.2	1,682	3.2	1,737	3.3	885	3.4	845	3.2
Initially English proficient	104	0.2	100	0.2	101	0.2	50	0.2	51	0.2
Title III exited	97	0.2	96	0.2	96	0.2	53	0.2	43	0.2
English Speaker I	160	0.3	163	0.3	163	0.3	74	0.3	89	0.3
English Speaker II	49,283	95.1	49,334	94.9	49,346	94.8	24,714	94.6	24,695	94.9
All others	438	0.8	533	1.0	534	1.0	321	1.2	252	1.0
Migrant										
Yes	12	0.0	11	0.0	11	0.0	8	0.0	3	0.0
No or unknown	51,835	100.0	51,989	100.0	52,058	100.0	26,129	100.0	26,024	100.0
Alternative School										
Yes	1,072	2.1	1,000	1.9	1,003	1.9	507	1.9	492	1.9
No or unknown	50,775	97.9	51,000	98.1	51,066	98.1	25,630	98.1	25,535	98.1
Customized Material										
Braille	5	0.0	6	0.0	6	0.0	3	0.0	3	0.0
Sign Language	0	0.0	1	0.0	2	0.0	0	0.0	1	0.0
Sign Language signed administration	14	0.0	15	0.0	16	0.0	6	0.0	10	0.0
Large print	28	0.1	18	0.0	18	0.0	7	0.0	10	0.0
Loose leaf	16	0.0	20	0.0	12	0.0	8	0.0	4	0.0
Form A oral administration	2,316	4.5	2,325	4.5	2,919	5.6	1,485	5.7	1,472	5.7
Total	2,379	4.6	2,385	4.6	2,973	5.7	1,509	5.8	1,500	5.8

Note: *N* = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing.

Source: Data Recognition Corporation

3.7 STANDARD AND NON-STANDARD ACCOMMODATIONS

Supplemental information regarding the administration of the PASS to students with disabilities is provided in Appendix C of the TAM (SCDE 2009b). That appendix—which provides guidelines for IEP teams in making decisions regarding testing students with disabilities—outlines specific information regarding testing accommodations, test forms and materials, and administration procedures.

Standard Accommodations

For South Carolina assessment programs, the term *standard accommodation* refers to any change in the testing environment, procedures, or presentation that does not alter in any significant way what the test measures. Accordingly, a standard accommodation has no effect on the comparability of scores. The purpose of such accommodations is to enable students to participate in an assessment in a way that allows knowledge and skills, rather than disabilities, to be assessed. Testing accommodations should be those typically used during routine instruction and assessment. Accommodations address areas such as setting, timing, scheduling, alternate response options, and presentation. Besides the specific accommodations listed in the TAM, others that are determined necessary by the IEP team can be used.

Non-Standard Accommodations

The term *non-standard accommodation* refers to any change in the testing process that compromises the validity of the results by altering the meaning and/or the comparability of test scores. Non-standard accommodations are appropriate only for those students with disabilities who, owing to the nature of their disabilities, are otherwise unable to take the PASS. Such accommodations should be the same as those used by the student in routine instruction and assessment.

Examples of non-standard accommodations allowed during the 2009 PASS administration are the use of spell checker and grammar checker for extended-response items, oral or signed administration of ELA (grades 3 and 4 only), and use of a calculator on the mathematics assessment (grades 3 and 4 only). Individual score reports for students with non-standard PASS administrations were documented as not comparable with other scores.

3.8 TEST LENGTH

The PASS is untimed. Students who finish the test before the rest of their classmates are allowed to read materials unrelated to the subject being tested, or they can leave the classroom if the school has made provisions for their supervision.

For each day, the start and stop times (within fifteen-minute intervals) were collected from each student's test booklet or answer document. Information on the amount of time spent in test administration each day can be used with other data to determine the structure and length of future tests. Table 5.3 describes the test times for the writing, ELA, mathematics, science, and social studies assessments. It includes the 25th percentile, the average, and the 75th percentile of the amount of time the students took to complete the assessments.

TABLE 3.8

Structure of Test Forms and Amount of Time for Administration

Grade	Content	Number of Items	Time in Minutes		
			25th Percentile	Median	75th Percentile
Grade 3	Writing Day 1	1 (30 points)	45	75	90
	Writing Day 2	25	45	60	75
	ELA	36	60	75	90
	Math	50	60	75	90
	Science	45	45	60	75
	Social Studies	45	45	60	75
Grade 4	Writing Day 1	1 (30 points)	60	75	105
	Writing Day 2	25	45	60	75
	ELA	36	60	75	90
	Math	56	60	75	105
	Science	45	45	60	75
	Social Studies	50	45	60	75
Grade 5	Writing Day 1	1 (30 points)	60	90	105
	Writing Day 2	25	45	60	75
	ELA	38	60	75	90
	Math	56	75	90	120
	Science	50	45	60	75
	Social Studies	50	45	60	75
Grade 6	Writing Day 1	1 (30 points)	60	75	90
	Writing Day 2	25	45	45	60
	ELA	40	45	60	75
	Math	61	75	90	105
	Science	55	45	60	75
	Social Studies	55	45	60	75
Grade 7	Writing Day 1	1 (30 points)	60	75	90
	Writing Day 2	25	45	45	60
	ELA	45	60	75	90
	Math	61	75	90	105
	Science	55	45	60	60
	Social Studies	60	45	60	75
Grade 8	Writing Day 1	1 (30 points)	45	60	90
	Writing Day 2	25	30	45	60
	ELA	50	60	75	90
	Math	63	75	90	120
	Science	60	45	60	75
	Social Studies	60	45	60	75

Source: SCDE

CHAPTER 4

SCORING

Scoring of items was completed using keys for multiple-choice items and a scoring rubric for extended-response items. This chapter describes the types of items used on the PASS as well as the scoring procedures.

4.1 TYPES OF ITEMS

On the PASS, all ELA, mathematics, science, and social studies items were multiple-choice. For writing, each grade-level exam contained both multiple-choice items and an extended-response item.

Multiple-Choice Items

These items required students to select a correct answer from several alternatives, generally four, although a few items had only three. Each correct multiple-choice item had a value of 1 point. Missing responses (items that a student did not answer) and multiple responses had a value of zero.

Extended-Response Items

These items, found only on the writing test, required a lengthy written response from students. The student was to write a full composition based on a prompt. Students were provided two pages on which to write a response.

Scoring Rubrics

Papers were scored using a modified holistic domain rubric. A student could earn as many as 15 points for each extended-response item. The total score was a composite of scores earned on four domains: content and development, organization, voice, and conventions. Each domain had a maximum score of 4 points, except voice, which had a maximum score of 3 points.

4.2 SCORING PROCESS

The DRC was responsible for the scoring, analyzing, and reporting of the PASS. Students responded in scannable answer documents. Multiple-choice items were scored electronically by the DRC's scanning system. Responses to multiple-choice items were recorded as correct, incorrect, omitted, or having multiple marks. Apparent erasures were also recorded.

Extended-response items were scored at a DRC scoring site outside of South Carolina. SCDE personnel were present on site for training and during the initial phases of scoring and

remained in contact as needed until scoring was complete. DRC staff conducted systematic reviews and analyses of student data on the extended-response items to help ensure accurate scoring.

Prior to scoring the 2009 PASS, student responses to extended-response items from previous field tests were submitted to range-finding committees of South Carolina educators who reviewed, scored, and agreed upon scores for "consensus sets" of papers based on state-approved scoring rubrics. Papers from these sets were used to construct training, qualifying, and recalibration sets that were used during scoring.

Training sets were used for initial rater training. Qualifying sets were used to establish the eligibility of an individual as a rater in the scoring process. To qualify as a rater for the extended-response items, an individual must demonstrate a rate of at least 70 percent exact agreement and 85 percent adjacent (i.e., within one point) agreement with the consensus scores for each domain on two out of three sets of twenty papers each.

4.3 QUALITY CONTROL FOR RATER ACCURACY

DRC is responsible for monitoring rater accuracy and implementing corrective measures as needed. Throughout the extended-response scoring, a rater must maintain at least 70 percent exact agreement on validity checks for each domain scored. Any rater who falls below the 70 percent rate on any domain can no longer score in that domain until retrained and re-qualified. All papers scored by that rater since the last acceptable validity check must be re-scored in that domain.

Throughout handscoring, daily calculations of inter-rater agreement must be provided to the SCDE. The minimum requirement for rater accuracy is an average inter-rater agreement of 70 percent. Overall inter-rater reliability must be maintained at 70 percent exact agreement. Scoring cannot be considered completed if the agreement rate is below this level.

CHAPTER 5

TECHNICAL CHARACTERISTICS OF THE 2009 PASS ITEMS

As noted previously, the PASS assessments are comprised of multiple-choice and (for writing only) extended-response items. This section documents the technical characteristics of these items.

5.1 MULTIPLE-CHOICE ITEMS

Item analyses were performed by Pearson for ELA, mathematics, science, and social studies and by DRC for writing. For each multiple-choice item, the analyses provided traditional item indices such as item difficulty (p-value), item discrimination (item/criterion point-biserial correlation), the proportion of examinees choosing each response, and option/criterion point-biserial correlations. The criterion variable for item discrimination was the raw score excluding the item under consideration. Mean *p*-values for all grades and subjects were in the vicinity of 0.60. Median point-biserials ranged from approximately 0.30 to 0.40. Table 5.1 provides a summary of the difficulty and discrimination indices for the multiple-choice items.

TABLE 5.1

Summary of Major Indices for Multiple-Choice Items

Grade	Content	Number of Items	Mean *p*-value	Median Point-Biserial
Grade 3	Writing	25	0.575	0.316
	ELA	36	0.594	0.396
	Math	50	0.634	0.348
	Science	45	0.606	0.339
	Social Studies	45	0.582	0.367
Grade 4	Writing	25	0.635	0.372
	ELA	36	0.687	0.377
	Math	56	0.610	0.387
	Science	45	0.647	0.359
	Social Studies	50	0.546	0.364
Grade 5	Writing	25	0.595	0.283
	ELA	38	0.661	0.352
	Math	56	0.576	0.370
	Science	50	0.570	0.296
	Social Studies	50	0.579	0.370
Grade 6	Writing	25	0.612	0.351
	ELA	40	0.657	0.367
	Math	61	0.592	0.393
	Science	55	0.603	0.368
	Social Studies	55	0.540	0.336
Grade 7	Writing	25	0.640	0.344
	ELA	45	0.664	0.388
	Math	61	0.552	0.370
	Science	55	0.603	0.339
	Social Studies	60	0.537	0.389
Grade 8	Writing	25	0.634	0.285
	ELA	50	0.637	0.348
	Math	63	0.508	0.398
	Science	60	0.585	0.368
	Social Studies	60	0.517	0.323

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing. Students who used Braille or sign language test booklets were also excluded since some items on these tests may differ from Form A.

Source: Data Recognition Corporation

5.2 EXTENDED-RESPONSE ITEMS

As with multiple-choice items, the characteristics of the extended-response items are reported in terms of *p*-value and item/criterion point-biserial correlation. While each writing form contained a single extended-response item, the item was scored on four domains, with each domain receiving a separate score. For ER items, *p*-value is the ratio of the item mean to the item maximum possible score (MPS). The discrimination index is the domain score-criterion correlation, with the criterion being the total raw score, excluding the domain under consideration. ER items had higher mean p-values and median discrimination indices than did MC items. Table 5.2 reports a summary of the major characteristics of the extended-response items.

TABLE 5.2

Summary of Major Indices for Extended-Response Items

Grade	Subject	Number of Scores	Mean *p*-value	Median Discrimination
3	WRITING	4	0.634	0.790
4	WRITING	4	0.689	0.717
5	WRITING	4	0.701	0.772
6	WRITING	4	0.723	0.795
7	WRITING	4	0.734	0.773
8	WRITING	4	0.765	0.753

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, and students who received an incomplete in writing. Students who used Braille or sign language test booklets were also excluded since some items on these tests may differ from Form A.

Source: Data Recognition Corporation

CHAPTER 6

SETTING PERFORMANCE STANDARDS

The Education Accountability Act of 2008, described in section 1.3, assigned the responsibility for setting achievement standards on PASS tests to the South Carolina Education Oversight Committee (EOC). In turn, the EOC contracted with DRC to conduct the standard-setting process. Committees of South Carolina educators were selected and met in Columbia, SC August 2-7, 2009. DRC processed the committees' recommendations and presented those results in a report to the EOC (Data Recognition Corporation 2010). After a series of public hearings, the EOC announced the final PASS standards and delivered them to SCDE.

6.1 METHOD OF SETTING CUT SCORES

To set performance standards for the PASS test, the EOC and DRC jointly decided on the Bookmark method (Lewis, Mitzel, and Green 1996). The Bookmark process uses an IRT framework to create an ordered item booklet (OIB), a document that contains a series of test items in order of increasing difficulty. The items reflect the expected range of abilities of students being tested. The OIB is presented to the standard-setting committee. Committee members are given descriptions of the performance levels for which standards are to be set. Members then review the OIB items and determine which items will be successfully completed at a specified response probability (RP) by students performing at the minimal level consistent with the performance level descriptions. (For PASS tests, an RP of 0.67 (Huynh 1994) was used.) Committee members place bookmarks between the items that, in their judgment, separate two adjacent achievement levels. Committees make several rounds of judgments, with intervening group discussions. Additional data on the impact of possible standards is also given to the committees.

Since PASS tests are administered in grades 3 through 8, it is reasonable to expect a degree of consistency in test results across grades. Following the initial committee meetings, panels were selected from the various subject-area committees to examine proposed standards across grades and recommend possible adjustments. After the committee meetings, DRC used an analytical smoothing function to better articulate the committees' recommendations for grade-by-grade standards. Based on this process and input from various groups at public hearings, the EOC then established the final PASS achievement standards.

6.2 POLICY DEFINITIONS

The following verbal descriptions of PASS achievement levels were given in Article 9 of the EAA (2008):

> **Not Met –** the student did not meet the grade level standard,

Met – the student met the grade level standard, and

Exemplary – the student demonstrated exemplary performance in meeting the grade level standard.

These descriptions provided the starting point for the standard-setting process. Although the EAA called for three performance levels, the EOC determined a total of five performance levels, dividing the Not Met and Exemplary categories into two parts each (known as Not Met 1, Not Met 2 and Exemplary 4, Exemplary 5, respectively) for use with state accountability procedures.

6.3 IMPLEMENTATION

The standard setting process, as conducted by DRC, was based on free (unanchored) Rasch calibrations of all subjects. Only this free calibration was available for writing. For the other subjects, test forms were calibrated by Pearson with item difficulty values anchored to the existing PACT scales. The table of cut scores provided to the SCDE by the EOC contained values based on DRC's free calibrations. It was necessary for SCDE staff to translate these cut scores (except for writing) to the anchored scale used by Pearson. The two scales were highly correlated ($\geq .97$) in every case. Since Rasch abilities are one-to-one with raw scores, the cut scores from both scales identified exactly the same sets of students at each performance level.

6.4 CUT SCORES

Table 6.1 provides the cut scores in terms of the Rasch ability and scale score. ELA, mathematics, science, and social studies cuts are on the anchored scale, while writing cuts are on the free-calibration scale.

TABLE 6.1

PASS Cut Scores: Scale Score (Rasch Ability)

ELA

	Achievement Level	
Grade	**Met**	**Exemplary**
3	600 (-0.2917)	643 (0.6651)
4	600 (-0.3974)	649 (0.8841)
5	600 (-0.4360)	661 (0.8523)
6	600 (-0.2993)	648 (0.7320)
7	600 (-0.3449)	644 (0.6214)
8	600 (-0.3080)	649 (0.6943)

Mathematics

	Achievement Level	
Grade	**Met**	**Exemplary**
3	600 (-0.2025)	642 (0.7325)
4	600 (-0.1874)	658 (1.1081)
5	600 (-0.1424)	659 (1.1179)
6	600 (-0.1562)	658 (1.1245)
7	600 (-0.0705)	652 (0.9868)
8	600 (-0.1305)	657 (1.0969)

Science

	Achievement Level	
Grade	**Met**	**Exemplary**
3	600 (-0.0607)	649 (0.8536)
4	600 (-0.0244)	674 (1.5273)
5	600 (-0.0933)	676 (1.2051)
6	600 (0.0701)	669 (1.4423)
7	600 (-0.0379)	664 (1.1415)
8	600 (-0.0249)	651 (0.9331)

Social Studies

	Achievement Level	
Grade	**Met**	**Exemplary**
3	600 (0.2612)	653 (1.3955)
4	600 (-0.3052)	668 (1.0129)
5	600 (-0.2394)	658 (0.8697)
6	600 (-0.2674)	671 (1.0234)
7	600 (-0.3974)	646 (0.5294)
8	600 (0.0666)	656 (0.9925)

Writing		
	Achievement Level	
Grade	Met	Exemplary
3	600 (-0.0641)	638 (0.7641)
4	600 (0.0956)	648 (1.2678)
5	600 (-0.1297)	649 (0.9117)
6	600 (0.0086)	651 (1.2008)
7	600 (0.2088)	647 (1.2923)
8	600 (0.3667)	651 (1.4311)

6.5 DESCRIPTIONS OF ACHIEVEMENT LEVELS

Prior to standard setting, the EOC and DRC developed expanded descriptions of the level of achievement expected of students at each of the performance levels defined in legislation. These are known as Descriptions of Achievement Levels (DALs). The DALs are unique to subject and grade. In some cases, the standard-setting committees made revisions to the DALs. A copy of the DALs can be found in Appendix A of DRC's 2009 PASS standard setting report (Data Recognition Corporation 2010).

6.6 PERCENTAGE OF STUDENTS IN EACH ACHIEVEMENT LEVEL

Table 6.2 provides the distribution of the 2009 PASS students in the three achievement levels for each grade and test. The data include all students who took Form A and other special forms, with a few exceptions. Home-schooled students, students with incomplete scores for ELA, and students who took a test using a non-standard accommodation are not included.

TABLE 6.2

Percentage of Students in Each Performance Level

			Percentage in Each Performance Level		
			Grade		
Grade	**Content**	**N**	**Not Met**	**Met**	**Exemplary**
3	**Writing**	54,425	31.1	29.4	39.5
	ELA	53,006	22.0	31.6	46.4
	Mathematics	54,691	32.9	35.8	31.2
	Science	27,650	38.4	43.1	18.4
	Social Studies	27,380	25.6	43.2	31.2
4	**Writing**	52,855	29.9	39.5	30.6
	ELA	51,377	24.4	39.2	36.5
	Mathematics	52,954	23.2	45.5	31.3
	Science	53,288	31.3	53.1	15.6
	Social Studies	53,240	20.2	52.1	27.7
5	**Writing**	52,133	26.8	38.2	35.0
	ELA	52,455	20.0	44.8	35.2
	Mathematics	52,505	26.5	45.7	27.8
	Science	26,372	31.7	54.1	14.2
	Social Studies	26,219	30.0	42.4	27.6
6	**Writing**	51,543	29.7	40.7	29.6
	ELA	51,859	28.3	39.7	32.0
	Mathematics	51,910	29.7	42.4	27.9
	Science	26,038	36.0	49.7	14.2
	Social Studies	25,971	20.4	55.7	23.9
7	**Writing**	51,440	29.9	40.3	29.8
	ELA	51,680	31.3	38.1	30.6
	Mathematics	51,735	30.6	42.9	26.6
	Science	51,703	28.9	48.9	22.3
	Social Studies	51,633	39.8	32.5	27.8
8	**Writing**	51,847	31.8	42.2	25.9
	ELA	52,000	32.5	38.9	28.6
	Mathematics	52,069	37.3	39.1	23.5
	Science	26,137	37.7	40.0	22.3
	Social Studies	26,027	30.4	40.3	29.3

CHAPTER 7

ITEM CALIBRATION AND SCALING

Item calibration, scaling, and linking for PASS assessments are based on item response theory (IRT) models. The one-parameter logistic (Rasch or 1PL) model (Rasch 1960) was used for the subjects of ELA, mathematics, science, and social studies. In writing, where test forms contained both multiple-choice items and an extended-response item, a mixed model incorporating the 1PL and the one-parameter partial credit (1PPC) model (Masters 1982) was used.

7.1 OVERVIEW

The PASS item banks incorporate items retained from the state's previous testing program, the PACT, along with additional newly-developed items. The original plan for the development and calibration of PASS test forms called for the development contractor, Pearson, to produce sets of pre-equated forms for all subjects except writing. Forms for writing would be post-equated by DRC due to a known shortage of multiple-choice writing items. However, for the first administration, the numbers of available items proved to be insufficient to produce multiple forms of ELA in grades 5 and 6. Instead, Pearson embedded some field test ELA items in the operational forms for these grades. After the test was administered, several of the embedded items with statistics that met SCDE criteria were treated as operational items in order to meet test blueprints.

7.2 ITEM CALIBRATION

Model and Software

Pearson performed item calibration for ELA, mathematics, science, and social studies, while DRC calibrated writing. WINSTEPS software was used for the calibrations by both contractors. Under the IRT models used for calibration, the raw score (total number of points) is the sufficient statistic for achievement. The calibration process yields a value of the Rasch ability measure known as theta for each possible raw score. Pearson-calibrated subjects were anchored using item difficulties from the PACT item bank. DRC performed a free (unanchored) calibration for writing, so that the 2009 administration defined the theta scale for this subject. Since theta scores contain negative numbers and decimal fractions, they are typically converted into scale scores for simplicity and ease of interpretation.

7.3 CALIBRATION DATA SETS

DRC conducted item calibrations for writing based on all students who attempted the writing test. In calibrating the four remaining subjects, Pearson removed home-schooled students, possible duplicate records, and students with blank or invalid data for their State ID numbers from the calibration.

7.4 PERFORMANCE LEVELS

PASS results are used to classify students into one of three performance levels: Not Met, Met, or Exemplary. The Met level is used as the proficiency criterion for both state and federal accountability purposes. The Exemplary level provides the level above proficiency as required by federal legislation. A description of the process by which cut scores for these levels were determined is given in Chapter 6.

7.5 SCALING

General Method of Scaling

The structure of the PASS scale score metric was determined by SCDE staff. In consultation with the TAC, it was decided that scores for 2009 would be reported on within-grade (horizontal) scales. The range of scale scores was set from 300 to 900; any scale score that exceeded these limits would be truncated at the limiting value. For every grade and subject, the scale score of 600 was set to correspond to the theta-scale met cut score, and the standard deviation of scale scores was set to 50, when rounded to an integer.

Scalable Students

Ability estimates were obtained for all students who responded to at least one item. Omissions and multiple responses (i.e., more than one response selected, without machine-discernable erasures) were scored as zeros.

Raw Scores

All subjects except writing are composed solely of multiple-choice items, so that the raw score is simply the number of items answered correctly. Writing forms for all grades contain twenty-five multiple-choice items and one extended-response item. The extended-response item is scored on four domains, according to an established scoring rubric, which features maximum scores of 4, 4, 3, and 4 for the four domains of Content and Development, Organization, Voice, and Conventions, respectively. The four extended-response domain scores are summed to get an extended-response total score, worth a maximum of 15 points. This score receives a weight of two in computing writing total scores. Thus, the raw score for writing is the number of multiple-choice items answered correctly, plus twice the extended-response score, for a maximum of 55 points.

Zero and Perfect Scores

In most IRT maximum-likelihood ability estimation methods, zero and perfect scores yield ability estimates of minus and plus infinity. In IRT applications, however, finite ability estimates are required for these scores. For the PASS, WINSTEPS default values were assigned for these extreme scores.

7.6 THE 2009 PASS SCALE SCORES

For ease of interpretation, PASS abilities for each grade and subject were converted into scale scores. The anchor point for all scales was the met cut point which was set to a scale score of 600; the standard deviation of scale scores was set to 50 for every grade and subject. Decisions on the scale score system were made by SCDE staff in consultation with Huynh Huynh of the TAC.

Calibration of PASS test forms yielded a value of the Rasch ability, theta (θ), corresponding to every possible raw score. Scale scores were calculated for every raw score for each grade and subject using the formula:

$$\text{[unrounded] scale score} = 600 + ((\theta_{RS} - \theta_{Met}) / \sigma_{\theta}) * 50, \text{ where}$$

θ_{RS} is the value of theta corresponding to that raw score,
θ_{Met} is the value of theta at the met cutpoint, and
σ_{θ} is the observed standard deviation of theta for the specified grade and subject.

Table 7.1 contains values of θ_{Met} and σ_{θ} for every grade and subject. Values of θ_{Met} were obtained from the PASS standards setting. Values of σ_{θ} were computed based on empirical data from the 2009 PASS administration.

TABLE 7.1

PASS Scaling Coefficients

Subject	Grade	θ_{Met}	σ_θ
ELA	3	-0.2917	1.1057
	4	-0.3974	1.2851
	5	-0.4360	1.0475
	6	-0.2993	1.0703
	7	-0.3449	1.0829
	8	-0.3080	1.0066
Math	3	-0.2025	1.0996
	4	-0.1874	1.1085
	5	-0.1424	1.0664
	6	-0.1562	1.0973
	7	-0.0705	1.0131
	8	-0.1305	1.0606
Science	3	-0.0607	0.9282
	4	-0.0244	1.0360
	5	-0.0933	0.8472
	6	0.0701	0.9822
	7	-0.0379	0.9210
	8	-0.0249	0.9362
Soc. Stud.	3	0.2612	1.0524
	4	-0.3052	0.9612
	5	-0.2394	0.9477
	6	-0.2674	0.9046
	7	-0.3974	0.9998
	8	0.0666	0.8189
Writing	3	-0.0641	1.0685
	4	0.0956	1.2007
	5	-0.1297	1.0582
	6	0.0086	1.1519
	7	0.2088	1.1450
	8	0.3667	1.0411

Each year, values of θ corresponding to each possible raw score will be determined empirically for each test form. The values of θ_{Met} and σ_θ for each grade and subject are constants that do not change from year to year. All scale scores are reported as integers. Unrounded scale score values are rounded down to the next lower integer.

At cut scores that do not translate to integer scale scores, it is possible for a raw score to correspond to a theta below the theta-level cut score yet still translate to a scale score value equal to the scale score cut. In such cases, the reported scale score is reduced by one point to fall below the scale score cut, thereby making the theta and scale score metrics consistent.

Vertical Scaling

The SCDE investigated the possibility of producing score scales that would be linked vertically (across grades). To that end, vertical linking items were included on operational forms. Pearson and DRC conducted vertical linking studies and presented the results to

SCDE. These studies can be found in Appendixes B-1 and B-2. After discussions with the TAC, it was decided not to produce vertical scales for 2009. Such scales remain a possibility for future administrations. If such scales are developed, they will be reported in addition to existing horizontal (within-grade) scales.

7.7 DATA REPORTING BY STANDARDS

General Procedure

Student performance by standard (or domain, in the case of writing) is reported in terms of the student's strengths and weaknesses. Based on their performance, students are placed into one of three categories at the standard or domain level:

1. those who show weakness and a need for further instruction in the standard/domain,
2. those who may benefit from additional activities that focus on the standard/domain, and
3. those who show strength in the standard/domain.

The following steps were utilized to determine the appropriate category for each standard/domain.

Steps in Categorization

The following procedure is used for each test form, by grade and subject:

Step 1: Every item on the form is assigned to a single content standard or domain, creating a subtest for that standard/domain.

Step 2: The calibrated item difficulties from the total form calibration are used to generate values of theta for each possible raw score on the subtest, along with its associated standard error of measurement.

Step 3: The lowest value of theta for the subtest which equals or exceeds the Met cutpoint on the total test is identified.

Step 4: A confidence interval of plus and minus one standard error of measurement is created around the score identified in step 3.

Step 5: The confidence interval is used to place students into one of the three categories:

- Category 1 contains students whose scores are below the confidence interval.
- Category 2 contains students whose scores are within the confidence interval.
- Category 3 contains students whose scores are above the confidence interval.

It should be noted that the standard-level categories 1, 2, and 3 do not correspond to the total-test performance levels Not Met, Met, and Exemplary. Indeed, as can be seen in the procedure described above, neither the Exemplary cut score nor performance level has an impact on standard-level categorizations.

CHAPTER 8

RELIABILITY

This chapter provides reliability indices and both classical standard errors of measurement (SEM) and conditional standard errors of measurement (cSEM) for the PASS assessments. Decision consistency measures for the PASS performance levels are also given.

8.1 RELIABILITY OF RAW SCORES

Reliability indices for the PASS assessments were computed using coefficient alpha (Cronbach 1951) for all tests except writing. The stratified coefficient alpha (Qualls 1995), appropriate for tests with mixed items types, was used for writing.

The stratified coefficient alpha is defined as

$$_{strat\,\alpha}\rho_{XX'} = 1 - \frac{\sum \sigma_{Y_j}^2 (1 - {}_{\alpha}\rho_{Y_jY_j'})}{\sigma_X^2}, \text{ where}$$

each test-part j is composed of all items of a given type;

σ_X^2 = the total score variance;

$\sigma_{Y_j}^2$ = the score variance for a part-test j; and

${}_{\alpha}\rho_{Y_jY_j'}$ = the reliability of the part-test j.

Table 8.1 provides reliability information on all subjects for the total student population and for students in each gender group and the ethnic groups of African-American, Hispanic, and white students. (The numbers of students in other ethnic groups such as American Indians, Asians, or mixed-race groups were deemed too small for reliability estimation.) Reliabilities were also determined for students with disabilities (SWD) and limited-English proficiency (LEP) students. Reliability data were compiled only for Form A of the assessments. TAC guidelines call for test forms to show reliability indices of at least 0.85.

TABLE 8.1

Classical Reliability Indices (Coefficient Alpha) Based on Raw Scores

Grade	Subject	Groups of Students							
		All	Female	Male	African-American	White	Hispanic	LEP	SWD
3	Writing	0.921	0.914	0.922	0.915	0.915	0.917	0.920	0.929
	ELA	0.862	0.856	0.865	0.827	0.857	0.847	0.847	0.854
	Math	0.897	0.891	0.902	0.867	0.890	0.880	0.886	0.893
	Science	0.853	0.839	0.865	0.822	0.842	0.822	0.823	0.849
	Soc. Stud.	0.886	0.877	0.894	0.850	0.884	0.871	0.875	0.872
4	Writing	0.915	0.908	0.916	0.901	0.909	0.915	0.919	0.917
	ELA	0.881	0.871	0.888	0.850	0.872	0.877	0.879	0.883
	Math	0.910	0.906	0.913	0.882	0.904	0.893	0.902	0.899
	Science	0.876	0.865	0.885	0.844	0.861	0.855	0.861	0.871
	Soc. Stud.	0.885	0.869	0.897	0.836	0.888	0.860	0.869	0.848
5	Writing	0.907	0.895	0.909	0.895	0.901	0.907	0.913	0.905
	ELA	0.849	0.834	0.858	0.821	0.837	0.843	0.849	0.835
	Math	0.906	0.902	0.910	0.871	0.903	0.895	0.903	0.868
	Science	0.848	0.831	0.862	0.789	0.838	0.819	0.830	0.818
	Soc. Stud.	0.882	0.866	0.895	0.845	0.881	0.865	0.868	0.858
6	Writing	0.924	0.916	0.926	0.913	0.919	0.917	0.925	0.909
	ELA	0.862	0.846	0.871	0.835	0.853	0.849	0.859	0.826
	Math	0.919	0.912	0.925	0.890	0.919	0.906	0.918	0.863
	Science	0.895	0.883	0.905	0.861	0.887	0.875	0.886	0.857
	Soc. Stud.	0.885	0.863	0.900	0.843	0.886	0.873	0.885	0.833
7	Writing	0.919	0.909	0.921	0.901	0.916	0.920	0.922	0.894
	ELA	0.890	0.877	0.897	0.877	0.878	0.885	0.881	0.850
	Math	0.908	0.897	0.917	0.854	0.912	0.883	0.886	0.809
	Science	0.886	0.870	0.898	0.857	0.879	0.877	0.878	0.842
	Soc. Stud.	0.913	0.897	0.925	0.880	0.916	0.904	0.902	0.850
8	Writing	0.902	0.889	0.905	0.886	0.896	0.906	0.908	0.889
	ELA	0.879	0.864	0.888	0.850	0.876	0.867	0.869	0.838
	Math	0.923	0.918	0.928	0.883	0.925	0.904	0.909	0.813
	Science	0.898	0.880	0.911	0.858	0.895	0.885	0.886	0.858
	Soc. Stud.	0.880	0.864	0.892	0.839	0.881	0.857	0.853	0.824

Note: ALL = All students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

As shown in table 8.1, reliability indices do not change much from the total student population to the students in each gender and ethnicity group. All subsequent data analyses for this section were therefore performed only on the total state student population.

8.2 STANDARD ERROR OF MEASUREMENT

The classical standard error of measurement (SEM) was computed using the traditional formula:

$$SEM = SD\sqrt{1 - reliability}$$

The SEMs are reported in table 8.2.

TABLE 8.2

Classical Standard Errors of Measurement Based on Scale Scores

Grade	Content	Overall SEM
3	Writing	14.0
	ELA	18.5
	Math	16.0
	Science	19.2
	Soc. Stud.	16.9
4	Writing	14.6
	ELA	17.2
	Math	15.0
	Science	17.6
	Soc. Stud.	17.0
5	Writing	15.3
	ELA	19.4
	Math	15.3
	Science	19.5
	Soc. Stud.	17.2
6	Writing	13.7
	ELA	18.6
	Math	14.2
	Science	16.2
	Soc. Stud.	17.0
7	Writing	14.2
	ELA	16.5
	Math	15.1
	Science	16.9
	Soc. Stud.	14.7
8	Writing	15.6
	ELA	17.3
	Math	13.9
	Science	16.0
	Soc. Stud.	17.3

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

8.3 CONDITIONAL SEM FOR SCALE SCORES

Conditional standard errors of measurement (cSEM) were computed for all subjects using WINSTEPS. Standard output from this program gives conditional standard errors of measurement for each raw score/theta, on the theta metric. Multiplying these values by the scaling constants from Section 7.5 (50 divided by the standard deviation of theta) gives cSEM on the scale-score metric.

Since scale scores are used for student reporting purposes, it is appropriate to report the scale score cSEM at the two cut scores that define the three performance levels. The resulting cSEM data are reported in table 8.3 for all grades and subjects.

TABLE 8.3

CSEM at PASS Scale Score Cuts

Grade	Subject	Met	Exemplary
3	Writing	15.35	15.94
	ELA	16.75	17.12
	Math	14.01	16.05
	Science	17.39	20.19
	Soc. Stud.	15.06	16.37
4	Writing	14.46	16.44
	ELA	14.26	17.26
	Math	13.18	14.69
	Science	15.67	20.85
	Soc. Stud.	15.83	16.35
5	Writing	15.74	17.40
	ELA	17.24	19.83
	Math	13.79	14.83
	Science	17.86	20.54
	Soc. Stud.	15.82	17.36
6	Writing	14.22	15.57
	ELA	16.50	19.08
	Math	12.55	13.96
	Science	14.57	18.40
	Soc. Stud.	15.89	16.63
7	Writing	13.98	15.76
	ELA	15.13	18.10
	Math	13.45	14.32
	Science	15.39	17.83
	Soc. Stud.	13.35	14.24
8	Writing	16.15	17.97
	ELA	15.71	18.00
	Math	12.67	13.32
	Science	14.48	16.52
	Soc. Stud.	16.64	16.95

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

8.4 CONSISTENCY OF PERFORMANCE LEVELS

Since it is not feasible to repeat PASS testing to determine the proportion of students who would be classified in the same performance levels, a statistical model needs to be imposed on the data to project the consistency of classifications. Although a number of procedures are available for this task, perhaps the two most well known are the methods developed by Huynh Huynh and Michael J. Subkoviak (Huynh 1976 and 1979; Subkoviak 1976). These two methods are known to yield similar results. However, the beta-binomial model used by Huynh is preferable because of its ability to provide standard errors for the estimates (Huynh and Saunders 1980).

Two indices of classification consistency are reported, the proportion of agreement (p) and kappa (κ). The agreement index is the proportion of students who are consistently classified in the same achievement level on two equivalent administrations of the test. The kappa index, on the other hand, reflects the level of improvement in the consistency of classifications beyond that expected by chance. The computer program RELI (Huynh 1979) was used for computing these consistency indices.

For each grade and subject, both agreement and kappa indices were computed in two ways. The first computation included all three performance levels, providing measures of consistency across all levels. Since the Not Met/Met distinction is important for both federal and state accountability ratings, the second computation combined the categories of Met and Exemplary. This case, using only two categories, offers fewer opportunities for differing classifications and therefore yields higher values of the consistency indices than the case of three categories. Values for both cases of the two consistency indices are shown in table 8.4.

TABLE 8.4

Consistency Indices for Performance Levels

Grade	Content	Two Achievement Levels		Three Achievement Levels	
		Proportion of Agreement	Kappa	Proportion of Agreement	Kappa
3	Writing	0.854	0.663	0.702	0.549
	ELA	0.872	0.624	0.710	0.545
	Math	0.866	0.697	0.738	0.605
	Science	0.828	0.637	0.703	0.530
	Soc. Stud.	0.878	0.677	0.746	0.607
4	Writing	0.852	0.648	0.697	0.542
	ELA	0.879	0.669	0.732	0.589
	Math	0.894	0.701	0.770	0.640
	Science	0.856	0.666	0.749	0.580
	Soc. Stud.	0.892	0.663	0.764	0.612
5	Writing	0.850	0.623	0.678	0.513
	ELA	0.873	0.603	0.702	0.530
	Math	0.885	0.702	0.767	0.637
	Science	0.839	0.629	0.736	0.549
	Soc. Stud.	0.864	0.674	0.737	0.596
6	Writing	0.865	0.677	0.721	0.577
	ELA	0.853	0.640	0.698	0.542
	Math	0.890	0.734	0.783	0.668
	Science	0.862	0.699	0.774	0.624
	Soc. Stud.	0.891	0.662	0.771	0.611
7	Writing	0.867	0.683	0.726	0.585
	ELA	0.865	0.688	0.728	0.591
	Math	0.879	0.714	0.767	0.642
	Science	0.869	0.680	0.752	0.604
	Soc. Stud.	0.876	0.739	0.777	0.662
8	Writing	0.844	0.640	0.694	0.532
	ELA	0.850	0.660	0.707	0.556
	Math	0.879	0.747	0.784	0.673
	Science	0.865	0.711	0.759	0.627
	Soc. Stud.	0.862	0.671	0.735	0.597

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing.

Source: Data Recognition Corporation

CHAPTER 9

VALIDITY

This section reports three types of validity evidence based on (1) test content, (2) internal structure, and (3) relations to other variables. Evidence on content validity is presented in terms of alignment studies comparing the 2009 PASS assessments with the state content standards. Internal structure is described by data showing the correlations among strands. This is followed by information regarding DIF with respect to gender and ethnicity.

9.1 ITEM ALIGNMENT WITH STANDARDS

The PASS assessments and item bank were reviewed by the EOC pursuant to the EAA (2008), beginning with a review of entire item banks and technical data which took place before the 2009 test administration. One hundred and forty-five South Carolina educators served as expert judges, evaluating the content tested and the levels of thinking demanded by the items. Following the spring 2009 test administration, the characteristics of the 2009 PASS tests were reviewed by another panel convened by the EOC.

The review of the alignment of the PASS item banks revealed both strengths and weaknesses in each content area. Strengths were observed in every subject area. An identified strength was that the banks included items assessing every academic standard to be tested. Similarly, weaknesses were identified for every subject area reviewed. One concern, observed primarily in ELA and Writing and, to a lesser extent, in Social Studies, was a shortage of items assessing some of the objectives or indicators specified in the state standards. This study is located on the EOC Web page under the link: http://eoc.sc.gov/NR/rdonlyres/06B20863-D516-4549-BC12-C5A6AA34A041/29057/PASSSubcommitteeDoc9909.pdf.

Tables 9.1 through 9.5 give the number and percentage of possible points by standard (or domain) for all regular PASS test forms.

TABLE 9.1

Form Composition for ELA

Grade	Measure	Points per Standard				Total
		1	2	3	6	
3	**Points**	10	9	8	9	36
	%	27.8%	25.0%	22.2%	25.0%	100.0%
4	**Points**	10	9	8	9	36
	%	27.8%	25.0%	22.2%	25.0%	100.0%
5	**Points**	9	12	8	9	38
	%	23.7%	31.6%	21.1%	23.7%	100.0%
6	**Points**	13	11	8	8	40
	%	32.5%	27.5%	20.0%	20.0%	100.0%
7	**Points**	15	12	9	9	45
	%	33.3%	26.7%	20.0%	20.0%	100.0%
8	**Points**	15	15	9	11	50
	%	30.0%	30.0%	18.0%	22.0%	100.0%

Source: Data Recognition Corporation

TABLE 9.2

Form Composition for Mathematics

Grade	Measure	Points per Standard					Total
		2	3	4	5	6	
3	**Points**	14	9	9	8	10	50
	%	28.0%	18.0%	18.0%	16.0%	20.0%	100.0%
4	**Points**	13	10	10	13	10	56
	%	23.2%	17.9%	17.9%	23.2%	17.9%	100.0%
5	**Points**	13	10	10	13	10	56
	%	23.2%	17.9%	17.9%	23.2%	17.9%	100.0%
6	**Points**	14	11	14	11	11	61
	%	23.0%	18.0%	23.0%	18.0%	18.0%	100.0%
7	**Points**	14	11	14	11	11	61
	%	23.0%	18.0%	23.0%	18.0%	18.0%	100.0%
8	**Points**	12	18	9	12	12	63
	%	19.0%	28.6%	14.3%	19.0%	19.0%	100.0%

Source: Data Recognition Corporation

TABLE 9.3

Form Composition for Science

Grade	Measure	Points per Standard						Total
		1	2	3	4	5	6	
3	Points	10	9	9	8	9	0	45
	%	22.2%	20.0%	20.0%	17.8%	20.0%	0.0%	100.0%
4	Points	10	9	8	8	10	0	45
	%	22.2%	20.0%	17.8%	17.8%	22.2%	0.0%	100.0%
5	Points	10	10	10	11	9	0	50
	%	20.0%	20.0%	20.0%	22.0%	18.0%	0.0%	100.0%
6	Points	12	11	10	11	11	0	55
	%	21.8%	20.0%	18.2%	20.0%	20.0%	0.0%	100.0%
7	Points	12	12	10	9	12	0	55
	%	21.8%	21.8%	18.2%	16.4%	21.8%	0.0%	100.0%
8	Points	11	9	11	10	9	10	60
	%	18.3%	15.0%	18.3%	16.7%	15.0%	16.7%	100.0%

Source: Data Recognition Corporation

TABLE 9.4

Form Composition for Social Studies

Grade	Measure	Points per Standard							Total
		1	2	3	4	5	6	7	
3	Points	8	9	9	10	9	0	0	45
	%	17.8%	20.0%	20.0%	22.2%	20.0%	0.0%	0.0%	100.0%
4	Points	8	8	9	8	8	9	0	50
	%	16.0%	16.0%	18.0%	16.0%	16.0%	18.0%	0.0%	100.0%
5	Points	9	8	8	8	9	8	0	50
	%	18.0%	16.0%	16.0%	16.0%	18.0%	16.0%	0.0%	100.0%
6	Points	9	10	9	9	9	9	0	55
	%	16.4%	18.2%	16.4%	16.4%	16.4%	16.4%	0.0%	100.0%
7	Points	8	8	9	9	9	9	8	60
	%	13.3%	13.3%	15.0%	15.0%	15.0%	15.0%	13.3%	100.0%
8	Points	8	9	9	9	9	8	8	60
	%	13.3%	15.0%	15.0%	15.0%	15.0%	13.3%	13.3%	100.0%

Source: Data Recognition Corporation

TABLE 9.5

Form Composition for Writing

Grade	Item Type	Measure	Points per Domain				Total	Grand Total
			1	2	3	4		
3	**MC**	**Points**	5	7	5	8	25	
		%	9.1%	12.7%	9.1%	14.5%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%
4	**MC**	**Points**	7	6	5	7	25	
		%	12.7%	10.9%	9.1%	12.7%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%
5	**MC**	**Points**	5	4	5	11	25	
		%	9.1%	7.3%	9.1%	20.0%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%
6	**MC**	**Points**	5	4	5	11	25	
		%	9.1%	7.3%	9.1%	20.0%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%
7	**MC**	**Points**	4	6	6	9	25	
		%	7.3%	10.9%	10.9%	16.4%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%
8	**MC**	**Points**	5	7	6	7	25	
		%	9.1%	12.7%	10.9%	12.7%	45.5%	
	ER	**Points**	8	8	6	8	30	55
		%	14.5%	14.5%	10.9%	14.5%	54.5%	100.0%

Note: Percentages were calculated using the grand total.
Source: Data Recognition Corporation

9.2 DIF FOR TEST ITEMS

Overview

One threat to the validity of a test is test bias, the unfair advantage of one group over another on the test. One way to examine for bias is to consider the items separately. DIF statistics focus on item validity as opposed to test validity; DIF occurs when examinees from different demographic groups but of otherwise equal achievement levels have unequal probabilities of success on an item. DIF is one indication of possible item bias. Large numbers of items showing DIF would be a possible indicator of test bias. Test items are classified according to

the observed severity of DIF. The severity classifications for DIF statistics utilized below are based on National Assessment of Educational Progress (NAEP) and Educational Testing Service (ETS) guidelines for the dichotomous items and on NAEP guidelines for the polytomous items (Allen, Carlson, and Zalanak 1999).

DIF for Multiple-Choice Items

All the 2009 PASS assessments were subjected to a formal DIF analysis based on the Mantel-Haenszel (MH) procedure. MH has a long tradition in DIF analysis and is considered effective and efficient (Clauser and Mazor 1998; Hills 1989). The MH uses both a statistical significance test and an analysis of the effect size.

In the use of MH for the multiple-choice items, examinees on each test were grouped by raw score (on the entire test) into ten strata with roughly the same number of examinees. Students in each stratum are considered to be equivalent in terms of ability. Then for each item, the students in the "focal" and "reference" groups were compared on the basis of their correct or incorrect responses. The term "focal" refers to the group of interest for DIF—in this case, female or African-American. The comparison or reference group was male or white, depending upon whether the DIF analysis was for gender or ethnicity.

Based on MH results, the items were classified as either "A," "B," or "C" as follows:

> "A" items are those for which MH D-DIF is not significantly different from 0 ($\alpha = .05$) or has an absolute value less than 1. These items are considered to be free of DIF. "B" items are those for which MH D-DIF is significantly different from 0 ($\alpha = .05$) and has either (a) an absolute value at least 1 but less than 1.5 or (b) an absolute value at least 1 but not significantly greater than 1 ($\alpha = .05$). These items may be used, but if there is a choice among otherwise equivalent items, it is considered desirable to select for inclusion in a test those with the smallest absolute value of MH D-DIF. "C" items are those for which the absolute value of MH D-DIF is at least 1.5 and is significantly greater than 1 ($\alpha = .05$). These items are to be selected only if it is essential to meet test specifications. (Zwick and Erikan 1989, 58–59)

DIF for Extended-Response Items

For polytomous items, DRC assessed DIF by examining the standardized mean difference (SMD), utilizing a procedure put forth in Dorans, Schmitt, and Bleistein (1992). The SMD is the difference between the unweighted item mean of the focal group and the weighted item mean of the reference group. The weights applied to the reference group are applied so that the weighted number of reference group students is the same as in the focal group (within the same ability group). The SMD is then divided by the total group item standard deviation, resulting in a measure of the effect size (ES) for the SMD. The MH procedure produces a probability (p) for the observed data.

The polytomous DIF classification is defined as follows:

Rule 1: If the probability *p* is >.05, classify the item as AA.
Otherwise:
Rule 2: If |ES| is ≤ .17, classify as AA.
Rule 3: If |ES| is >.17 but ≤.25, classify as BB.
Rule 4: If |ES| is >.25, classify as CC.

Results

Tables 9.6 – 9.10 provide a summary of DIF classifications for all subjects. More than 95% of all multiple-choice items are classified as "A" items, showing little of no DIF. In fact, the numbers of multiple-choice items classified as "C" items for gender and ethnic DIF were smaller than could be expected due to chance alone. The data indicate that the 2009 PASS assessments for ELA, mathematics, science, and social studies showed very little DIF for either gender or ethnicity. This is also true for multiple-choice items in writing. However, there were a number of scores for the writing ER items that were flagged for gender DIF. These scores consistently favored females, with differences in p-values between genders of as much as 0.082. This result was surprising because, while the ER prompt was not flagged by the bias review panel, some observers felt that the prompt might be advantageous to males.

TABLE 9.6

Summary of DIF Classification for ELA Items

Grade	Reference Group	Focal Group	Total N of Items	DIF Classification		
				A	B	C
3	Male	Female	36	35	0	1
	White	African-American	36	34	2	0
4	Male	Female	36	36	0	0
	White	African-American	36	34	1	1
5	Male	Female	38	36	2	0
	White	African-American	38	35	3	0
6	Male	Female	40	38	2	0
	White	African-American	40	39	1	0
7	Male	Female	45	45	0	0
	White	African-American	45	44	1	0
8	Male	Female	50	43	5	2
	White	African-American	50	46	2	2
All Grades	**Male**	**Female**	**245**	**233**	**9**	**3**
	White	**African-American**	**245**	**232**	**10**	**3**

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.7

Summary of DIF Classification for Mathematics

Grade	Reference Group	Focal Group	Total N of Items*	DIF Classification		
				A	B	C
3	Male	Female	50	49	1	0
	White	African-American	50	49	0	1
4	Male	Female	56	56	0	0
	White	African-American	56	53	3	0
5	Male	Female	55	52	3	0
	White	African-American	55	53	2	0
6	Male	Female	60	56	4	0
	White	African-American	60	56	4	0
7	Male	Female	61	60	1	0
	White	African-American	61	60	1	0
8	Male	Female	63	60	2	1
	White	African-American	63	61	0	2
All Grades	**Male**	**Female**	**345**	**333**	**11**	**1**
	White	**African-American**	**345**	**332**	**10**	**3**

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

***** DIF could not be calculated for one item in grade 5 and one item in grade 6 because the items were scored as correct for all students.

Source: Data Recognition Corporation

TABLE 9.8

Summary of DIF Classification for Science

Grade	Reference Group	Focal Group	Total *N* of Items	DIF Classification		
				A	B	C
3	Male	Female	45	44	1	0
	White	African-American	45	45	0	0
4	Male	Female	45	45	0	0
	White	African-American	45	45	0	0
5	Male	Female	50	49	1	0
	White	African-American	50	47	2	1
6	Male	Female	55	50	4	1
	White	African-American	55	52	3	0
7	Male	Female	55	53	2	0
	White	African-American	55	52	3	0
8	Male	Female	60	57	3	0
	White	African-American	60	55	5	0
All Grades	**Male**	**Female**	**310**	**298**	**11**	**1**
	White	**African-American**	**310**	**296**	**13**	**1**

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.9

Summary of DIF Classification for Social Studies

Grade	Reference Group	Focal Group	Total *N* of Items	DIF Classification		
				A	B	C
3	Male	Female	45	45	0	0
	White	African-American	45	44	1	0
4	Male	Female	50	50	0	0
	White	African-American	50	50	0	0
5	Male	Female	50	50	0	0
	White	African-American	50	48	2	0
6	Male	Female	55	54	0	1
	White	African-American	55	54	1	0
7	Male	Female	60	57	3	0
	White	African-American	60	59	1	0
8	Male	Female	60	59	1	0
	White	African-American	60	58	1	1
All Grades	**Male**	**Female**	**320**	**315**	**4**	**1**
	White	**African-American**	**320**	**313**	**6**	**1**

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.10

Summary of DIF Classification for Writing

Grade	Item Type	Reference Group	Focal Group	Total *N* of Items	DIF Classification		
					A / AA	B / BB	C / CC
3	MC	Male	Female	25	24	1	0
		White	African-American	25	24	1	0
	ER	Male	Female	4	0	1	3
		White	African-American	4	2	2	0
4	MC	Male	Female	25	25	0	0
		White	African-American	25	24	1	0
	ER	Male	Female	4	0	0	4
		White	African-American	4	1	2	1
5	MC	Male	Female	25	25	0	0
		White	African-American	25	24	1	0
	ER	Male	Female	4	0	0	4
		White	African-American	4	2	1	1
6	MC	Male	Female	25	25	0	0
		White	African-American	25	24	0	1
	ER	Male	Female	4	0	0	4
		White	African-American	4	2	1	1
7	MC	Male	Female	25	25	0	0
		White	African-American	25	25	0	0
	ER	Male	Female	4	0	1	3
		White	African-American	4	2	2	0
8	MC	Male	Female	25	25	0	0
		White	African-American	25	25	0	0
	ER	Male	Female	4	1	2	1
		White	African-American	4	1	2	1
All Grades	**MC**	**Male**	**Female**	**150**	**149**	**1**	**0**
		White	**African-American**	**150**	**146**	**3**	**1**
	ER	**Male**	**Female**	**24**	**1**	**4**	**19**
		White	**African-American**	**24**	**10**	**10**	**4**

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

9.4 CORRELATION AMONG STANDARDS

Tables 9.11 through 9.15 provide a summary of the Pearson product-moment correlations among standards, based on raw scores.

TABLE 9.11

Summary of the Correlations among ELA Standards

Grade	Smallest	Median	Largest
3	0.552	0.588	0.638
4	0.604	0.631	0.680
5	0.519	0.577	0.619
6	0.563	0.604	0.651
7	0.597	0.635	0.694
8	0.540	0.619	0.670

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.12

Summary of the Correlations among Math Standards

Grade	Smallest	Median	Largest
3	0.486	0.581	0.660
4	0.524	0.611	0.688
5	0.538	0.614	0.670
6	0.595	0.646	0.692
7	0.588	0.638	0.702
8	0.589	0.648	0.729

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.13

Summary of the Correlations among Science Standards

Grade	Smallest	Median	Largest
3	0.500	0.519	0.548
4	0.494	0.544	0.604
5	0.450	0.505	0.568
6	0.579	0.597	0.641
7	0.542	0.580	0.622
8	0.507	0.563	0.630

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.14

Summary of the Correlations among Social Studies Standards

Grade	Smallest	Median	Largest
3	0.526	0.568	0.635
4	0.501	0.542	0.578
5	0.451	0.527	0.607
6	0.476	0.542	0.636
7	0.462	0.553	0.677
8	0.366	0.479	0.602

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

TABLE 9.15

Summary of the Correlations among Writing Domains

Grade	Smallest	Median	Largest
3	0.685	0.719	0.772
4	0.677	0.715	0.776
5	0.671	0.692	0.782
6	0.716	0.731	0.825
7	0.707	0.725	0.796
8	0.633	0.679	0.771

Note: Analyses included all students who attempted the test **except:** home school students, students who used non-standard testing accommodations, students who received an incomplete in writing, and students who used Braille or sign language test booklets.

Source: Data Recognition Corporation

REFERENCES

Allen, Nancy L., James E. Carlson, and Christine A. Zalanak. 1999. *The NAEP 1996 Technical Report.* Washington, DC: National Center for Education Statistics.

Anderson, L. & Krathwohl, D. A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman, 2001**.**

Clauser, Brian E., and Kathleen M. Mazor. 1998. "An NCME Instructional Module on Using Statistical Procedures to Identify Differentially Functioning Test Items." *Educational Measurement: Issues and Practice* 17:31–44.

Cronbach, L.J. 1951. "Coefficient alpha and the internal structure of tests." *Psychometrika* 16:297-334.

Data Recognition Corporation. 2010. *August 2009 PASS Standard Setting Technical Report*. Columbia: South Carolina Education Oversight Committee.

Dorans, Neil J., Alicia P. Schmitt, and Carole A. Bleistein. 1992. "The Standardization Approach to Assessing Comprehensive Differential Item Functioning." *Journal of Educational Measurement* 29:309–19.

Hills, John R. 1989. "Screening for Potentially Biased Items in Testing Programs." *Educational Measurements Issues and Practice* 8: 5–11.

Huynh, Huynh. 1976. "On the Reliability of Decisions in Domain-Referenced Testing." *Journal of Educational Measurement* 13:253–64.

———. 1979. "Computational and Statistical Inference for Two Reliability Indices Based on the Beta-Binomial Model." *Journal of Educational Statistics* 4:231–46.

———. 1994. "Some Technical Aspects in Standard Setting." In *Proceedings of the Joint Conference on Standard Setting for Large Scale Assessment Programs*, 75–91. Washington, DC: National Assessment Governing Board and National Center for Education Statistics.

Huynh, Huynh, and Joseph C. Saunders. 1980. "Accuracy of Two Procedures for Estimating Reliability of Mastery Tests." *Journal of Educational Measurement* 17:351–58.

Lewis, Daniel M., Harold C. Mitzel, and Donald R. Green. 1996. "Standard Setting: A Bookmark Approach." Paper presented at the Council of Chief State School Officers National Conference on Large-Scale Assessment," June 23–26, Phoenix, Arizona.

Linacre, John M. 2002. *A User's Guide to WINSTEPS.* Chicago: Mesa Press.

Masters, Geofferey N. 1982. "A Rasch Model for Partial Credit Scoring." *Psychometrika* 49:269–72.

Qualls, Audrey L. 1995. "Estimating the Reliability of a Test Containing Multiple Item Formats." *Applied Measurement in Education* 8:111–20.

Rasch, Georg. 1960. *Probabilistic Models for Some Intelligence and Attainment Tests.* Copenhagen: Danish Institute for Educational Research.

SCDE. 2009a. *District Test Coordinator's Supplement for the South Carolina Palmetto Assessment of State Standards.* Columbia: South Carolina Department of Education.

———. 2009b. *Test Administration Manual for the South Carolina Palmetto Assessment of State Standards.* Columbia: South Carolina Department of Education.

Subkoviak, Michael J. 1976. "Estimating Reliability from a Single Administration of a Criterion-Referenced Test." *Journal of Educational Measurement* 13:265–76.

Zwick, Rebecca, and Kadriye Ericikan. 1989. "Analysis of Differential Item Functioning in the NAEP History Assessment." *Journal of Educational Measurement* 26:55–66.

Appendix A
PASS Standards and Domains

Tables A1–A4 contain the standards for PASS ELA, Mathematics, Science, and Social Studies. Instead of standards, Writing uses four domains: Content and Development, Organization, Voice, and Conventions.

TABLE A1

ELA Standards (All Grades)

Standard	Description
1	Reading: Literary Texts
2	Reading: Informational Texts
3	Reading: Building Vocabulary
6	Researching

TABLE A2

Mathematics Standards (All Grades)

Standard	Description
2	Number & Operations
3	Algebra
4	Geometry
5	Measurement
6	Data Analysis & Probability

TABLE A3

Science Standards by Grade

Grade	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5	Standard 6
3	Scientific Inquiry	Habitats & Adaptation	Earth's Materials & Changes	Heat & Changes in Matter	Motion & Sound	
4	Scientific Inquiry	Organisms & Their Environments	Astronomy	Weather	Properties of Light & Electricity	
5	Scientific Inquiry	Ecosystems: Terrestrial & Aquatic	Landforms & Oceans	Properties of Matter	Forces & Motion	
6	Scientific Inquiry	Plants: Structures, Processes, & Responses	Animals: Structures, Processes, & Responses	Earth's Atmosphere & Weather	Conservation of Energy	
7	Scientific Inquiry	Cells & Heredity	Human Body Systems & Disease	Ecology: Biotic & Abiotic Environment	Chemical Nature of Matter	
8	Scientific Inquiry	Earth's Biological History	Earth's Structure & Processes	Astronomy: Earth & Space Systems	Forces & Motion	Waves

TABLE A4

Social Studies Standards by Grade

Grade	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5	Standard 6	Standard 7
3	Places, Regions, & Human Systems	Exploration & Settlement	American Revolution & New Nation	Civil War & Reconstruction	Late 19th & 20th Century S.C.		
4	Exploration	Settlement	Colonial Conflict	A New Nation	Westward Movement	Civil War	
5	Reconstruction	Westward Expansion	U.S. as a World Power	The 1920s & 1930s	Cold War	Developments Since 1992	
6	Cradles of Civilization	Ancient Classical Civilizations	The Middle Ages	Other Pre-Renaissance Cultures	Renaissance & Reformation	European Exploration & Settlement	
7	European Colonial Expansion	Absolute Monarchies & Constitutional Government	Age of Revolution	Global Imperialism	Early 20th Century World Conflicts	Post-World War II	20th Century (to Present) Changes
8	Settlement of S.C. & the U.S.	S.C. in the Revolution & New Nation	The Civil War	Reconstruction in S.C.	Late 19th Century U.S.	Early 20th Century S.C.	Mid to Late 20th Century S.C.

Appendix B-1

Spring 2009 PASS Writing
Vertical Scaling Analysis

The linking plan for the PASS writing vertical scale was developed by the item and test development contractor. This plan included appended sets of vertical linking items (six per set). Two distinct types of vertical links were included: Operational items tested at a higher grade (e.g., grade 3 operational items administered to grade 4 students) and operational items tested at a lower grade (e.g., grade 4 operational items administered to grade 3 students). The first type of links will be referred to as "grade-higher" links and the second type of links will be referred to as "grade-lower" links. For grade-higher links, the previous year's instruction will have provided opportunities to learn. However, that opportunity may not have been reinforced in the higher grade. For the grade-lower links, the opportunities to learn are less clear and will vary from item to item, depending on the curriculum overlap between the two grades.

There were eight vertical linking test forms for grades 4 through 7 and four vertical linking forms for grades 3 and 8. (This is due to the fact that there were no grade-lower items for grade 3 and no grade-higher items for grade 8.) The initial plan was to have 24 items available for each of the grade-higher and grade-lower vertical links. However, in all cases, there were only 19 or 20 items available for the analysis, depending on the grade. This is due to the fact that after the preliminary analysis of the data some of the items chosen as vertical linking items were designated as field-test items on the grade-appropriate forms. These items were designated as field-test items based, primarily, on poor item statistics and would not have been good candidates for developing a vertical scale. The presence or absence of these four to five items per link should have no systematic bias on the link constants estimated for this study. The remaining 39 or 40 linking items between forms should provide adequate sampling to determine a stable link constant between the grade levels.

The methodology used in this vertical linking study is based on the separate calibration approach developed by Wright and Bell (1984). This approach allows for the calculation of both unweighted and weighted link constants along with the estimation error associated with each link constant. The WINSTEPS program (v. 3.68) was used for all calibrations. The calibration methodology used in this study is a modified anchor item approach. In this method, all operational multiple-choice (MC) items were calibrated independently. In the second calibration, all MC items were anchored at the values from the first calibration and the extended-response (ER) item (composed of four scoring domains with the appropriate weights) was added. The second calibration was used to estimate the sample means for the six grades. These six grade-level estimates will be used later to test the developed vertical scale. The third calibration, which is used to estimate the vertical linking constants, utilized only multiple-choice items. All operational multiple-choice items were anchored at their MC-only item difficulties, and all items designated as field-test items were excluded from the analysis. The missing data feature of WINSTEPS was used to place all appropriate vertical linking on the common origin defined by the specific grade-level operational items. This

single grade-level calibration that uses either four or eight vertical linking item sets, depending on the grade, is commonly referred to as a concurrent calibration.

The resulting WINSTEPS item output files from the six grade-level calibrations were used as input to a proprietary linking program designed to implement the Rasch model linking methods described in Wright and Bell (1984). The complete output from these analyses can be found in Appendix 1. Figure 1 (shown on page 3) lists part of the output for the estimation of the grade 3/4 link constant. The first line of the figure indicates that the unweighted link constant based on the 39 common items is 0.153. The standard error of this link constant is 0.004. The next section of the figure lists the grade 3 item difficulties for the 39 common items in the column labeled Diff 1. The associated asymptotic standard errors for these item difficulties are found in the column labeled SE 1. The grade 4 item difficulties, adjusted by the unweighted link constant, are found in the column labeled Diff 2. The associated asymptotic standard errors for these item difficulties are found in the column labeled SE 2. The column labeled d-diff shows the difference between the two estimates of the item's difficulty on the common metric. The *t*-test column shows the magnitude of the difference in item difficulties in relation to the standard error of the difference as calculated by the Wright and Stone *t*-test (Wright and Stone, 1979). This statistic is distributed as a *t*-statistic and, as such, values greater than ±5 should be rare. In this example, there are 17 item pairs with values greater that ±10 and 12 values between ±5 and ±10. This means that 29 of the 39 items (74%) have *t*-test values greater than ±5.

The key to equating in the Rasch model is to find a subset of the linking items that remain invariant (have the same item difficulty) across the two forms that are to be equated. This usually implies finding pairs of item difficulty that are statistically equivalent as measured by the *t*-test. If the traditional *t*-test values for inclusion of an item pair of an absolute value less than ±2 is used, only six of the 39 items would be eligible for the link and the link constant would be 0.137 (with a SE of 0.012). If a less conservative value of ±3 was used to determine inclusion, only seven items would be selected and the link constant would be 0.130 (with a SE of 0.011). Both of these estimates are within approximately two standard errors of the unweighted link constant based on all 39 items. The link constants associated with critical values of ±1.5, ±2.0, ±3.0, ±4.0, and ±5.0 for item inclusion are provided at the bottom of Figure 1. Because of the large sample sizes involved in the calibrations and the similarity of the link constants from the different critical values, the less conservative critical value of ±3 was chosen for including items in the calculation of the unweighted link constants reported throughout this study.

Figure 1. Linking Program Output

```
Unweighted Link Constant    0.153
Unweighted Link S.E.        0.004

Weighted Link Constant      0.212
Weighted Link S.E.          0.004


Linked Item Difficulties - Unweighted Link Constant

  No.   Bank ID             Diff 1   Diff 2  SE 1   SE 2   t-test   d-diff
    1   NEW083002-08350     -0.24     0.47   0.01   0.02   -27.34    -0.70
    2   NEW083006-08350      2.22     2.05   0.01   0.03     5.60     0.17
    3   NEW083003-08350     -0.55    -0.17   0.01   0.02   -14.65    -0.39
    4   NEW083027-08353      0.24     0.70   0.01   0.03   -15.15    -0.45
    5   NEW083029-08353      0.43     0.88   0.01   0.03   -14.92    -0.45
    6   E300404W02           0.84     1.09   0.01   0.02    -9.51    -0.25
    7   E301203W000          0.56     0.98   0.01   0.03   -14.12    -0.42
    8   NEW083007-08352      0.56     0.53   0.01   0.03     0.93     0.03
    9   E3S40713             0.48     0.54   0.01   0.02    -2.38    -0.06
   10   E3S40714            -1.65    -1.32   0.01   0.04    -7.78    -0.33
   11   E31135347           -0.67    -0.69   0.01   0.03     0.40     0.01
   12   E3S40706            -1.00    -0.95   0.01   0.04    -1.23    -0.05
   13   E3S40703             0.84     1.05   0.01   0.03    -6.95    -0.21
   14   E3S40704             0.93     1.15   0.01   0.03    -7.50    -0.23
   15   NEW083017-08351      0.90     1.13   0.01   0.03    -7.48    -0.23
   16   NEW083015-08351      0.07     0.17   0.01   0.03    -3.05    -0.10
   17   NEW083020-08351      0.07     0.09   0.01   0.03    -0.68    -0.02
   18   E3S40710            -1.05    -0.81   0.01   0.04    -6.58    -0.24
   19   E300405W02           0.37     0.84   0.01   0.02   -18.43    -0.47
   20   NEW084007-08450     -0.44    -0.83   0.02   0.01    17.97     0.40
   21   NEW084009-08450      0.06    -0.45   0.02   0.01    24.46     0.51
   22   E4S40710            -0.31    -0.71   0.02   0.01    18.20     0.39
   23   E4S40751             0.79     0.62   0.02   0.01     7.41     0.16
   24   E4S40753             0.89     0.93   0.02   0.01    -1.58    -0.03
   25   E4S40755            -0.63    -0.60   0.02   0.01    -1.56    -0.04
   26   NEW084020-08451      0.30    -0.06   0.02   0.01    16.29     0.36
   27   NEW084023-08451      0.62     0.47   0.02   0.01     6.77     0.15
   28   NEW084025-08451      1.02     0.71   0.02   0.01    13.81     0.31
   29   NEW084016-08454      0.22     0.12   0.02   0.01     4.44     0.10
   30   NEW084018-08454      0.81     1.20   0.02   0.01   -17.74    -0.39
   31   NEW084013-08454      0.47     0.02   0.02   0.01    20.49     0.45
   32   NEW084015-08454      0.45    -0.18   0.02   0.01    28.20     0.63
   33   E4W03067            -0.50    -0.70   0.02   0.01     8.44     0.20
   34   E400905W1           -0.20    -0.44   0.02   0.01    10.49     0.24
   35   NEW084000-08453     -0.17    -0.07   0.02   0.01    -4.53    -0.10
   36   NEW084004-08453      0.65     0.15   0.02   0.01    22.64     0.50
   37   NEW084001-08453      1.05     0.83   0.02   0.01     9.98     0.22
   38   E400505W1           -0.47    -0.93   0.02   0.01    18.76     0.45
   39   E400605W1            0.53     0.65   0.02   0.01    -5.75    -0.12


t-test value for exclusion         1.5          t-test value for exclusion         4.0
Number of items included             4          Number of items included             8
Revised Unweighted Link Constant     0.146      Revised    Unweighted    Link    Constant
0.121
Revised Unweighted Link S.E.         0.017      Revised     Unweighted     Link      S.E.
0.010


t-test value for exclusion         2.0          t-test value for exclusion         5.0
Number of items included             6          Number of items included            10
Revised Unweighted Link Constant     0.137      Revised    Unweighted    Link    Constant
0.127
Revised Unweighted Link S.E.         0.012      Revised     Unweighted     Link      S.E.
0.008


t-test value for exclusion         3.0
```

Number of items included	7
Revised Unweighted Link Constant	0.130
Revised Unweighted Link S.E.	0.011

Table 1 contains the link constants based on all items and the link constants using a critical value of ±3. The standard errors for the link constants and the number of items included in each link constant are also shown.

Table 1
Unweighted Link Constants

Link Grades	Link Constant All Items	Link Constant *SE*	*N* of Items	Link Constant $\lvert t \rvert < 3.0$	Link Constant *SE*	*N* of Items
3/4	0.153	0.004	39	0.130	0.011	7
4/5	0.562	0.005	39	0.581	0.011	10
5/6	0.066	0.005	39	0.076	0.010	9
6/7	0.136	0.004	40	0.140	0.010	9
7/8	0.155	0.004	39	0.129	0.021	2

The comparison of the two link constant columns suggests that both numbers may be estimating the same population statistic. The number of items for the restricted link constant ($\lvert t \rvert < 3.0$) is very low. Only between 5% and 25% of the available items were included in the link. This clearly indicates that the unweighted link constant does a poor job of describing the central tendency of these pairs of item difficulties because there appears to be two means, one for each of the two linking sets, grade-higher items and grade-lower items.

A possible cause for this can be seen in Figure 1. In this figure, the first 19 items listed are the grade 3 operational items appended to the grade 4 test (grade-higher links). The final 20 items are the grade 4 operational items appended to the grade 3 test (grade-lower links). A casual inspection of the *t*-test values for the first 19 items indicates that there is one large positive value and 11 large negative values. One would expect that these values would be approximately normally distributed with approximately equal numbers of positive and negative values with a mean of approximately zero, if the mean was a good description of this subpopulation. For the last 20 items listed, there are 15 large positive values and only one large negative value. This further supports the conclusion that the overall mean is not a good description of the combined set of links. There appear to be two very different subsets of items which behave quite differently, the grade-higher links and the grade-lower links. This will be explored in more detail later in this report.

Table 2 lists the mean measures for all grades. The unlinked mean measure is taken from the operational calibration that included the MC and ER items. The linked mean measures are the mean measures after the linking constants have been applied to all grades. In the original calibrations, there are six unique origins. The linking procedure places all of the scales on a common origin. The choice of the common origin is arbitrary. In this case, grade 5 was selected by the South Carolina Department of Education (SCDE) as the common origin. In this table, the grade 5 mean is the same for the unlinked and the linked mean measures. To place the grade 4 mean on the grade 5 origin, the grade 4/5 link constant was subtracted from the grade 4 mean measure (0.76 – 0.562 = 0.20). To place the grade 3 mean on the grade 5

origin the grade 4/5 and the grade 3/4 link constants were subtracted from the grade 3 mean measure (0.42 – 0.562 – 0.153 = –0.30).

Table 2
Mean Measures for Grades
Unlinked and Linked

Grade	Unlinked Mean Measure	Linked Mean Measures All Items	Linked Mean Measures $\lvert t \rvert < 3.0$
3	0.42	–0.30	–0.29
4	0.76	0.20	0.18
5	0.53	0.53	0.53
6	0.62	0.69	0.70
7	0.74	0.94	0.96
8	0.78	1.13	1.13

The linked mean measures for all items in column three and the $\lvert t \rvert < 3.0$ mean measures in column four are very similar. There appears to be no advantage to restricting the number of items to fitting items only (items with *t*-statistics between +3.0 and -3.0) in this case. The progression of mean measures from grade to grade follows expectations. There is approximately a 0.5 logit growth from grades 3 to 4, about a 0.3 logit growth from grades 4 to 5, about a 0.15 logit growth from grades 5 to 6, about a 0.25 logit growth from grades 6 to 7, and about a 0.15 logit growth from grades 7 to 8. This pattern suggests that more growth occurs earlier in schooling and continues throughout the later grades at a moderate rate.

To confirm the stability (sample independence) of the link constants, two subpopulation analyses were performed. At the suggestion of the SCDE, one subpopulation was created for districts 2601 and 1001 (Sample 1). A second subpopulation was created for districts 2301, 4201, 4202, 4203, 4204, 4205, 4206 and 4207 (Sample 2). The results of calculating the linking constants for these two subpopulations are presented in Table 3. The methodology used for calculating the unweighted link constants was the same as the methodology used for the total population. The table provides the results for both the total number of linking items and the best-fit subset of linking items. With a few exceptions, the values of the link constants are quite similar across the three groups (Total Sample, Sample 1, and Sample 2). The use of either the all-items link constant or only the best-fitting-items link constant again appears to have little impact on the results.

Table 3
Unweighted Link Constants for Subpopulations

Grade Link	Statistic	All Linking Items			$\|t\| < 3.0$ Items Only		
		Total Sample	Sample 1	Sample 2	Total Sample	Sample 1	Sample 2
3/4	LC	0.153	0.120	0.148	0.130	0.100	0.158
	SE	0.004	0.010	0.012	0.011	0.016	0.019
	NI	39	39	39	7	16	17
4/5	LC	0.562	0.554	0.624	0.581	0.560	0.650
	SE	0.005	0.013	0.016	0.011	0.019	0.021
	NI	39	39	39	10	18	24
5/6	LC	0.066	0.058	0.037	0.076	0.050	0.079
	SE	0.005	0.012	0.015	0.010	0.019	0.021
	NI	39	39	39	9	18	23
6/7	LC	0.136	0.169	0.149	0.140	0.134	0.179
	SE	0.005	0.012	0.015	0.010	0.017	0.021
	NI	40	40	40	9	21	21
7/8	LC	0.115	0.109	0.137	0.129	0.125	0.157
	SE	0.004	0.010	0.013	0.021	0.017	0.019
	NI	39	39	39	2	14	20

LC=Link constant, SE =Standard error of the link constant, and
NI= Number of items included in link

There remains one outstanding issue that might impact the results. As mentioned in the opening description, all vertical linking items were tested in the usual position on-grade. For off-grade administrations, the items were appended. That is, they were placed at the end of the test. This guarantees that every off-grade item will appear later in the test form, and the effects changes in position on item difficulty may bias the results. In an effort to highlight this problem, the average change in position between on-grade and off-grade testing was calculated. The results of this analysis are shown in Table 4. On average, the appended items appeared about 19 items later in the test for the off-grade administration than they appeared in the on-grade administration. There were very slight differences between the position change for the grade-higher items and the grade-lower items. When items appear later on an examination, there may be fatigue or time management issues that make an item appear harder than it would if the item appeared earlier in the test. The extent to which this change in item position may have influenced the results is impossible to estimate using the current design, but it is a factor that needs to be considered.

Table 4
Unweighted Link Constants

Grades	Grade-higher Items			Grade-lower Items		
	Number of Items	Average Change in Position	Range of Change in Position	Number of Items	Average Change in Position	Range of Change in Position
3	19	19.0	6 - 30	--	--	--
4	20	20.4	6 - 30	20	18.7	8 - 30
5	19	17.7	5 - 30	19	19.0	6 - 29
6	20	17.9	7 - 25	20	20.4	6 - 30
7	20	18.0	4 - 28	20	17.7	5 - 30
8	--	--	--	19	17.9	7 - 30

If not for the fact that the item pairs that sum to the link constants here are so unstable (as discussed in Figure 1), this might seem to be an acceptable vertical scale. However, it is possible to approach the linking using only tested grade-higher items *or* only tested grade-lower items to estimate the link constants. Furthermore, there are instructional considerations that may favor one group of link items over the other. When the item pairs are split into the two groups, the results are quite different. Table 5 provides a comparison of the estimated link constants calculated using the three methods: all linking items, grade-higher items only, and grade-lower items only.

Table 5
Unweighted Link Constants for Different Anchor Sets

Grade Link	Statistic	All Linking Items			$\|t\| < 3.0$ Items Only		
		All Linking Items	Grade-higher Only	Grade-lower Only	All Linking Items	Grade-higher Only	Grade-lower Only
3/4	LC	0.153	–0.078	0.372	0.130	–0.094	0.360
	SE	0.004	0.007	0.005	0.011	0.013	0.011
	NI	39	19	20	7	6	4
4/5	LC	0.562	0.352	0.783	0.581	0.386	0.757
	SE	0.005	0.007	0.007	0.011	0.012	0.018
	NI	39	20	19	10	7	3
5/6	LC	0.066	–0.155	0.276	0.076	–0.167	0.290
	SE	0.005	0.007	0.007	0.010	0.012	0.012
	NI	39	19	20	9	7	8
6/7	LC	0.136	–0.094	0.366	0.140	–0.135	0.362
	SE	0.005	0.007	0.007	0.010	0.011	0.011
	NI	40	20	20	9	8	8
7/8	LC	0.115	–0.147	0.390	0.129	–0.144	0.380
	SE	0.004	0.005	0.007	0.021	0.014	0.012
	NI	39	20	19	2	3	7

LC=Link constant, SE =Standard error of the link constant, and
NI= Number of items included in link

The linking output for all of the analyses conducted on the grade-higher only items and the grade-lower only items is contained in Appendix 2. There is a considerable difference between the link constants based on the grade-higher only items and the grade-lower only items. The grade 3/4 link constant for all items is 0.153. The link constant for the grade-higher only items is –0.078. The link constant for the grade-lower only items is 0.372. There is a 0.45 logit difference between the grade-higher only link constant and the grade-lower only link constant. A difference of that magnitude is quite significant. If this difference were converted to a *t*-statistic using the standard error of the difference, the value would be 52.31. Clearly, the grade- lower only items point to one solution and using the grade-higher only items point to a different solution. Combining all of the items and calculating a single link constant cannot produce a defensible solution.

Table 6 compares the mean measures for the six grades using the three sets of linking constants. The cross-grade comparisons are quite different. The grade-higher only analysis shows modest growth in writing skills up to grade 5, with a plateau in achievement after that. The all-items linking analysis shows moderate growth across all years and the grade-lower only analysis shows impressive gains across all six grades, with a minimum 0.4 logit growth each year.

Table 6
Mean Measures for Grades
Six Methods Compared

Grade	Unlinked Mean Measure	Linked Mean Measures All Items	Linked Mean Measures $\lvert t \rvert < 3.0$	Grade-higher All Items	Grade-higher $\lvert t \rvert < 3.0$	Grade-lower All Items	Grade-lower $\lvert t \rvert < 3.0$
3	0.42	–0.30	–0.29	0.15	0.13	–0.74	–0.70
4	0.76	0.20	0.18	0.41	0.37	–0.02	0.00
5	0.53	0.53	0.53	0.53	0.53	0.53	0.53
6	0.62	0.69	0.70	0.47	0.45	0.90	0.91
7	0.74	0.94	0.96	0.49	0.44	1.38	1.39
8	0.78	1.13	1.13	0.38	0.33	1.81	1.81

The important question is: Which one of these solutions provides the best picture of the skills, knowledge, and achievement of South Carolina students? These data suggest that the linking design was problematic, with the use of both grade-higher and grade-lower linking items and the practice of appended linking items for all off-grades. The use of grade-higher only items and the grade-lower only items to estimate the link constant points to two very different pictures of the average measures for the students. Taking the average (as is the case using both grade-higher and grade-lower items) only masks the problem, and it is probably not the best solution. The choice is then between the grade-higher only and the grade-lower only solutions. The nature of the impact asking grade 4 students to respond to grade 3 items that might not have been reviewed in the current curriculum versus asking grade 3 students to respond to grade 4 items that may not have been presented in the grade 3 curriculum must be considered. The information to make this decision will require the careful content review of the items and, possibly, the collection of additional data before the vertical scale for writing can be approved with confidence.

References

Wright, B.D., & Bell, S.R. (1984). Item banks: What, why, how. *Journal of Educational Measurement*, *21*, 331-345.

Wright, B.D., & Stone, M. H. (1979). *Best test design*. Chicago: MESA Press.

Appendix 1

Grade 3-4 Linking Results

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g3wvlif.txt No. of Items - 49
Input File 2 - g4wvlif.txt No. of Items - 73

No.	Bank ID	g3wvlif.t Diff 1	g4wvlif.t Diff 2	SE 1	SE 2
1	NEW083002-08350	-0.24	0.31	0.01	0.02
2	NEW083006-08350	2.22	1.90	0.01	0.03
3	NEW083003-08350	-0.55	-0.32	0.01	0.02
4	NEW083027-08353	0.24	0.54	0.01	0.03
5	NEW083029-08353	0.43	0.72	0.01	0.03
6	E300404W02	0.84	0.94	0.01	0.02
7	E301203W000	0.56	0.83	0.01	0.03
8	NEW083007-08352	0.56	0.38	0.01	0.03
9	E3S40713	0.48	0.39	0.01	0.02
10	E3S40714	-1.65	-1.47	0.01	0.04
11	E31135347	-0.67	-0.84	0.01	0.03
12	E3S40706	-1.00	-1.10	0.01	0.04
13	E3S40703	0.84	0.90	0.01	0.03
14	E3S40704	0.93	1.00	0.01	0.03
15	NEW083017-08351	0.90	0.97	0.01	0.03
16	NEW083015-08351	0.07	0.01	0.01	0.03
17	NEW083020-08351	0.07	-0.06	0.01	0.03
18	E3S40710	-1.05	-0.96	0.01	0.04
19	E300405W02	0.37	0.69	0.01	0.02
20	NEW084007-08450	-0.44	-0.98	0.02	0.01
21	NEW084009-08450	0.06	-0.61	0.02	0.01
22	E4S40710	-0.31	-0.86	0.02	0.01
23	E4S40751	0.79	0.47	0.02	0.01
24	E4S40753	0.89	0.77	0.02	0.01
25	E4S40755	-0.63	-0.75	0.02	0.01
26	NEW084020-08451	0.30	-0.21	0.02	0.01
27	NEW084023-08451	0.62	0.32	0.02	0.01
28	NEW084025-08451	1.02	0.56	0.02	0.01
29	NEW084016-08454	0.22	-0.03	0.02	0.01
30	NEW084018-08454	0.81	1.04	0.02	0.01
31	NEW084013-08454	0.47	-0.14	0.02	0.01
32	NEW084015-08454	0.45	-0.33	0.02	0.01
33	E4W03067	-0.50	-0.86	0.02	0.01
34	E400905W1	-0.20	-0.60	0.02	0.01
35	NEW084000-08453	-0.17	-0.23	0.02	0.01
36	NEW084004-08453	0.65	0.00	0.02	0.01
37	NEW084001-08453	1.05	0.67	0.02	0.01
38	E400505W1	-0.47	-1.08	0.02	0.01
39	E400605W1	0.53	0.50	0.02	0.01
Mean		0.22	0.06		

Unweighted Link Constant 0.153
Unweighted Link S.E. 0.004

Weighted Link Constant 0.212
Weighted Link S.E. 0.004

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW083002-08350	-0.24	0.47	0.01	0.02	-27.34	-0.70
2	NEW083006-08350	2.22	2.05	0.01	0.03	5.60	0.17
3	NEW083003-08350	-0.55	-0.17	0.01	0.02	-14.65	-0.39
4	NEW083027-08353	0.24	0.70	0.01	0.03	-15.15	-0.45
5	NEW083029-08353	0.43	0.88	0.01	0.03	-14.92	-0.45
6	E300404W02	0.84	1.09	0.01	0.02	-9.51	-0.25

7	E301203W000	0.56	0.98	0.01	0.03	-14.12	-0.42
8	NEW083007-08352	0.56	0.53	0.01	0.03	0.93	0.03
9	E3S40713	0.48	0.54	0.01	0.02	-2.38	-0.06
10	E3S40714	-1.65	-1.32	0.01	0.04	-7.78	-0.33
11	E31135347	-0.67	-0.69	0.01	0.03	0.40	0.01
12	E3S40706	-1.00	-0.95	0.01	0.04	-1.23	-0.05
13	E3S40703	0.84	1.05	0.01	0.03	-6.95	-0.21
14	E3S40704	0.93	1.15	0.01	0.03	-7.50	-0.23
15	NEW083017-08351	0.90	1.13	0.01	0.03	-7.48	-0.23
16	NEW083015-08351	0.07	0.17	0.01	0.03	-3.05	-0.10
17	NEW083020-08351	0.07	0.09	0.01	0.03	-0.68	-0.02
18	E3S40710	-1.05	-0.81	0.01	0.04	-6.58	-0.24
19	E300405W02	0.37	0.84	0.01	0.02	-18.43	-0.47
20	NEW084007-08450	-0.44	-0.83	0.02	0.01	17.97	0.40
21	NEW084009-08450	0.06	-0.45	0.02	0.01	24.46	0.51
22	E4S40710	-0.31	-0.71	0.02	0.01	18.20	0.39
23	E4S40751	0.79	0.62	0.02	0.01	7.41	0.16
24	E4S40753	0.89	0.93	0.02	0.01	-1.58	-0.03
25	E4S40755	-0.63	-0.60	0.02	0.01	-1.56	-0.04
26	NEW084020-08451	0.30	-0.06	0.02	0.01	16.29	0.36
27	NEW084023-08451	0.62	0.47	0.02	0.01	6.77	0.15
28	NEW084025-08451	1.02	0.71	0.02	0.01	13.81	0.31
29	NEW084016-08454	0.22	0.12	0.02	0.01	4.44	0.10
30	NEW084018-08454	0.81	1.20	0.02	0.01	-17.74	-0.39
31	NEW084013-08454	0.47	0.02	0.02	0.01	20.49	0.45
32	NEW084015-08454	0.45	-0.18	0.02	0.01	28.20	0.63
33	E4W03067	-0.50	-0.70	0.02	0.01	8.44	0.20
34	E400905W1	-0.20	-0.44	0.02	0.01	10.49	0.24
35	NEW084000-08453	-0.17	-0.07	0.02	0.01	-4.53	-0.10
36	NEW084004-08453	0.65	0.15	0.02	0.01	22.64	0.50
37	NEW084001-08453	1.05	0.83	0.02	0.01	9.98	0.22
38	E400505W1	-0.47	-0.93	0.02	0.01	18.76	0.45
39	E400605W1	0.53	0.65	0.02	0.01	-5.75	-0.12

t-test value for exclusion 1.5
Number of items included 4
Revised Unweighted Link Constant 0.146
Revised Unweighted Link S.E. 0.017

t-test value for exclusion 2.0
Number of items included 6
Revised Unweighted Link Constant 0.137
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 3.0
Number of items included 7
Revised Unweighted Link Constant 0.130
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 8
Revised Unweighted Link Constant 0.121
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 10
Revised Unweighted Link Constant 0.127
Revised Unweighted Link S.E. 0.008

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW083002-08350	-0.24	0.53	0.01	0.02	-29.63
2	NEW083006-08350	2.22	2.11	0.01	0.03	3.66
3	NEW083003-08350	-0.55	-0.11	0.01	0.02	-16.88

4	NEW083027-08353	0.24	0.76	0.01	0.03	-17.12
5	NEW083029-08353	0.43	0.94	0.01	0.03	-16.90
6	E300404W02	0.84	1.15	0.01	0.02	-11.75
7	E301203W000	0.56	1.04	0.01	0.03	-16.08
8	NEW083007-08352	0.56	0.59	0.01	0.03	-1.01
9	E3S40713	0.48	0.60	0.01	0.02	-4.68
10	E3S40714	-1.65	-1.26	0.01	0.04	-9.17
11	E31135347	-0.67	-0.63	0.01	0.03	-1.25
12	E3S40706	-1.00	-0.89	0.01	0.04	-2.78
13	E3S40703	0.84	1.11	0.01	0.03	-8.90
14	E3S40704	0.93	1.21	0.01	0.03	-9.45
15	NEW083017-08351	0.90	1.19	0.01	0.03	-9.43
16	NEW083015-08351	0.07	0.22	0.01	0.03	-4.93
17	NEW083020-08351	0.07	0.15	0.01	0.03	-2.54
18	E3S40710	-1.05	-0.75	0.01	0.04	-8.18
19	E300405W02	0.37	0.90	0.01	0.02	-20.71
20	NEW084007-08450	-0.44	-0.77	0.02	0.01	15.30
21	NEW084009-08450	0.06	-0.40	0.02	0.01	21.66
22	E4S40710	-0.31	-0.65	0.02	0.01	15.48
23	E4S40751	0.79	0.68	0.02	0.01	4.73
24	E4S40753	0.89	0.98	0.02	0.01	-4.25
25	E4S40755	-0.63	-0.54	0.02	0.01	-3.99
26	NEW084020-08451	0.30	0.00	0.02	0.01	13.63
27	NEW084023-08451	0.62	0.53	0.02	0.01	4.09
28	NEW084025-08451	1.02	0.77	0.02	0.01	11.17
29	NEW084016-08454	0.22	0.18	0.02	0.01	1.78
30	NEW084018-08454	0.81	1.26	0.02	0.01	-20.41
31	NEW084013-08454	0.47	0.07	0.02	0.01	17.82
32	NEW084015-08454	0.45	-0.12	0.02	0.01	25.55
33	E4W03067	-0.50	-0.65	0.02	0.01	5.98
34	E400905W1	-0.20	-0.39	0.02	0.01	7.94
35	NEW084000-08453	-0.17	-0.01	0.02	0.01	-7.14
36	NEW084004-08453	0.65	0.21	0.02	0.01	19.95
37	NEW084001-08453	1.05	0.89	0.02	0.01	7.32
38	E400505W1	-0.47	-0.87	0.02	0.01	16.31
39	E400605W1	0.53	0.71	0.02	0.01	-8.46

t-test value for exclusion 1.5
Number of items included 2
Revised Weighted Link Constant 0.175
Revised Weighted Link S.E. 0.023

t-test value for exclusion 2.0
Number of items included 3
Revised Weighted Link Constant 0.215
Revised Weighted Link S.E. 0.016

t-test value for exclusion 3.0
Number of items included 5
Revised Weighted Link Constant 0.187
Revised Weighted Link S.E. 0.013

t-test value for exclusion 4.0
Number of items included 7
Revised Weighted Link Constant 0.190
Revised Weighted Link S.E. 0.011

t-test value for exclusion 5.0
Number of items included 12
Revised Weighted Link Constant 0.193
Revised Weighted Link S.E. 0.008

Grade 4-5 Linking Results

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g4wvlif.txt No. of Items - 73
Input File 2 - g5wvlif.txt No. of Items - 73

No.	Bank ID	g4wvlif.t Diff 1	g5wvlif.t Diff 2	SE 1	SE 2
1	NEW084007-08450	-0.98	-1.00	0.01	0.03
2	NEW084009-08450	-0.61	-0.71	0.01	0.02
3	E400505W1	-1.08	-1.53	0.01	0.04
4	E400605W1	0.50	0.27	0.01	0.03
5	NEW084016-08454	-0.03	-0.17	0.01	0.03
6	NEW084018-08454	1.04	0.96	0.01	0.03
7	NEW084013-08454	-0.14	-0.52	0.01	0.03
8	NEW084015-08454	-0.33	-0.42	0.01	0.03
9	NEW084000-08453	-0.23	-0.82	0.01	0.03
10	NEW084004-08453	0.00	-0.47	0.01	0.03
11	NEW084001-08453	0.67	0.29	0.01	0.03
12	E4S40751	0.47	0.05	0.01	0.03
13	E4S40753	0.77	0.25	0.01	0.03
14	E4S40755	-0.75	-0.96	0.01	0.03
15	NEW084020-08451	-0.21	-0.58	0.01	0.03
16	NEW084023-08451	0.32	-0.30	0.01	0.03
17	NEW084025-08451	0.56	-0.11	0.01	0.03
18	E4W03067	-0.86	-1.44	0.01	0.04
19	E400905W1	-0.60	-1.00	0.01	0.03
20	E4S40710	-0.86	-1.17	0.01	0.03
21	NEW085008-08550	0.23	-0.84	0.03	0.01
22	NEW085012-08550	2.46	1.82	0.03	0.01
23	NEW085010-08550	0.75	-0.24	0.03	0.01
24	NEW085011-08550	-0.71	-1.91	0.03	0.01
25	E51135577	-0.17	-0.90	0.03	0.01
26	E5W03062	-0.06	-0.95	0.03	0.01
27	E5W03064	-0.82	-1.24	0.03	0.01
28	NEW085015-08551	2.63	2.25	0.04	0.01
29	NEW085021-08551	0.16	-1.00	0.03	0.01
30	NEW085017-08551	1.16	0.36	0.03	0.01
31	E500502W1	-0.69	-1.69	0.03	0.01
32	NEW085001-08552	1.39	0.72	0.03	0.01
33	NEW085000-08552	0.45	-0.50	0.03	0.01
34	E5S407135	1.09	0.36	0.03	0.01
35	E5S407134	0.63	0.27	0.03	0.01
36	E5S407132	1.30	0.66	0.03	0.01
37	E5S407130	2.05	1.41	0.03	0.01
38	E5S40734	0.85	-0.10	0.03	0.01
39	E5S40727	0.84	0.20	0.03	0.01
Mean		0.29	-0.27		

Unweighted Link Constant 0.562
Unweighted Link S.E. 0.005

Weighted Link Constant 0.553
Weighted Link S.E. 0.005

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW084007-08450	-0.98	-0.44	0.01	0.03	-19.12	-0.54
2	NEW084009-08450	-0.61	-0.15	0.01	0.02	-16.84	-0.46
3	E400505W1	-1.08	-0.97	0.01	0.04	-2.73	-0.11
4	E400605W1	0.50	0.83	0.01	0.03	-11.17	-0.33
5	NEW084016-08454	-0.03	0.40	0.01	0.03	-13.74	-0.43
6	NEW084018-08454	1.04	1.52	0.01	0.03	-15.95	-0.48
7	NEW084013-08454	-0.14	0.05	0.01	0.03	-5.65	-0.18
8	NEW084015-08454	-0.33	0.14	0.01	0.03	-14.61	-0.47
9	NEW084000-08453	-0.23	-0.26	0.01	0.03	1.09	0.04

10	NEW084004-08453	0.00	0.09	0.01	0.03	-2.66	-0.09
11	NEW084001-08453	0.67	0.86	0.01	0.03	-6.09	-0.18
12	E4S40751	0.47	0.62	0.01	0.03	-4.80	-0.15
13	E4S40753	0.77	0.81	0.01	0.03	-1.16	-0.04
14	E4S40755	-0.75	-0.39	0.01	0.03	-10.02	-0.36
15	NEW084020-08451	-0.21	-0.02	0.01	0.03	-5.83	-0.19
16	NEW084023-08451	0.32	0.27	0.01	0.03	1.58	0.05
17	NEW084025-08451	0.56	0.46	0.01	0.03	3.42	0.11
18	E4W03067	-0.86	-0.87	0.01	0.04	0.42	0.02
19	E400905W1	-0.60	-0.43	0.01	0.03	-4.56	-0.16
20	E4S40710	-0.86	-0.60	0.01	0.03	-8.82	-0.26
21	NEW085008-08550	0.23	-0.28	0.03	0.01	16.34	0.51
22	NEW085012-08550	2.46	2.38	0.03	0.01	2.23	0.08
23	NEW085010-08550	0.75	0.32	0.03	0.01	13.95	0.43
24	NEW085011-08550	-0.71	-1.35	0.03	0.01	17.51	0.64
25	E51135577	-0.17	-0.34	0.03	0.01	5.39	0.18
26	E5W03062	-0.06	-0.39	0.03	0.01	10.09	0.33
27	E5W03064	-0.82	-0.67	0.03	0.01	-3.89	-0.14
28	NEW085015-08551	2.63	2.81	0.04	0.01	-5.03	-0.19
29	NEW085021-08551	0.16	-0.44	0.03	0.01	19.38	0.61
30	NEW085017-08551	1.16	0.92	0.03	0.01	8.05	0.24
31	E500502W1	-0.69	-1.13	0.03	0.01	12.47	0.45
32	NEW085001-08552	1.39	1.28	0.03	0.01	3.69	0.11
33	NEW085000-08552	0.45	0.07	0.03	0.01	12.70	0.39
34	E5S407135	1.09	0.92	0.03	0.01	5.54	0.17
35	E5S407134	0.63	0.83	0.03	0.01	-6.84	-0.21
36	E5S407132	1.30	1.22	0.03	0.01	2.71	0.08
37	E5S407130	2.05	1.97	0.03	0.01	2.17	0.07
38	E5S40734	0.85	0.47	0.03	0.01	12.87	0.39
39	E5S40727	0.84	0.76	0.03	0.01	2.65	0.08

t-test value for exclusion 1.5
Number of items included 3
Revised Unweighted Link Constant 0.568
Revised Unweighted Link S.E. 0.020

t-test value for exclusion 2.0
Number of items included 4
Revised Unweighted Link Constant 0.579
Revised Unweighted Link S.E. 0.017

t-test value for exclusion 3.0
Number of items included 10
Revised Unweighted Link Constant 0.581
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 13
Revised Unweighted Link Constant 0.582
Revised Unweighted Link S.E. 0.009

t-test value for exclusion 5.0
Number of items included 15
Revised Unweighted Link Constant 0.559
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW084007-08450	-0.98	-0.45	0.01	0.03	-18.79
2	NEW084009-08450	-0.61	-0.16	0.01	0.02	-16.50
3	E400505W1	-1.08	-0.98	0.01	0.04	-2.50
4	E400605W1	0.50	0.82	0.01	0.03	-10.86
5	NEW084016-08454	-0.03	0.39	0.01	0.03	-13.44
6	NEW084018-08454	1.04	1.51	0.01	0.03	-15.64

7	NEW084013-08454	-0.14	0.04	0.01	0.03	-5.36
8	NEW084015-08454	-0.33	0.13	0.01	0.03	-14.32
9	NEW084000-08453	-0.23	-0.27	0.01	0.03	1.36
10	NEW084004-08453	0.00	0.08	0.01	0.03	-2.37
11	NEW084001-08453	0.67	0.85	0.01	0.03	-5.78
12	E4S40751	0.47	0.61	0.01	0.03	-4.50
13	E4S40753	0.77	0.80	0.01	0.03	-0.85
14	E4S40755	-0.75	-0.40	0.01	0.03	-9.75
15	NEW084020-08451	-0.21	-0.03	0.01	0.03	-5.55
16	NEW084023-08451	0.32	0.26	0.01	0.03	1.87
17	NEW084025-08451	0.56	0.45	0.01	0.03	3.72
18	E4W03067	-0.86	-0.88	0.01	0.04	0.65
19	E400905W1	-0.60	-0.44	0.01	0.03	-4.30
20	E4S40710	-0.86	-0.61	0.01	0.03	-8.50
21	NEW085008-08550	0.23	-0.29	0.03	0.01	16.63
22	NEW085012-08550	2.46	2.37	0.03	0.01	2.48
23	NEW085010-08550	0.75	0.31	0.03	0.01	14.25
24	NEW085011-08550	-0.71	-1.35	0.03	0.01	17.77
25	E51135577	-0.17	-0.35	0.03	0.01	5.68
26	E5W03062	-0.06	-0.40	0.03	0.01	10.37
27	E5W03064	-0.82	-0.68	0.03	0.01	-3.64
28	NEW085015-08551	2.63	2.81	0.04	0.01	-4.79
29	NEW085021-08551	0.16	-0.45	0.03	0.01	19.68
30	NEW085017-08551	1.16	0.91	0.03	0.01	8.36
31	E500502W1	-0.69	-1.14	0.03	0.01	12.73
32	NEW085001-08552	1.39	1.27	0.03	0.01	3.99
33	NEW085000-08552	0.45	0.06	0.03	0.01	13.01
34	E5S407135	1.09	0.91	0.03	0.01	5.85
35	E5S407134	0.63	0.83	0.03	0.01	-6.53
36	E5S407132	1.30	1.21	0.03	0.01	3.01
37	E5S407130	2.05	1.96	0.03	0.01	2.45
38	E5S40734	0.85	0.46	0.03	0.01	13.18
39	E5S40727	0.84	0.75	0.03	0.01	2.96

t-test value for exclusion 1.5
Number of items included 3
Revised Weighted Link Constant 0.563
Revised Weighted Link S.E. 0.020

t-test value for exclusion 2.0
Number of items included 4
Revised Weighted Link Constant 0.577
Revised Weighted Link S.E. 0.017

t-test value for exclusion 3.0
Number of items included 9
Revised Weighted Link Constant 0.577
Revised Weighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 13
Revised Weighted Link Constant 0.590
Revised Weighted Link S.E. 0.009

t-test value for exclusion 5.0
Number of items included 16
Revised Weighted Link Constant 0.556
Revised Weighted Link S.E. 0.008

Grade 5-6 Linking Results

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g5wvlif.txt No. of Items - 73
Input File 2 - g6wvlif.txt No. of Items - 73

No.	Bank ID	g5wvlif.t Diff 1	g6wvlif.t Diff 2	SE 1	SE 2
1	NEW085008-08550	-0.84	-0.44	0.01	0.02
2	NEW085012-08550	1.82	1.57	0.01	0.03
3	NEW085010-08550	-0.24	0.02	0.01	0.02
4	NEW085011-08550	-1.91	-1.15	0.01	0.03
5	NEW085015-08551	2.25	1.97	0.01	0.03
6	NEW085021-08551	-1.00	-0.59	0.01	0.03
7	NEW085017-08551	0.36	0.54	0.01	0.03
8	E500502W1	-1.69	-1.49	0.01	0.04
9	E51135577	-0.90	-1.03	0.01	0.03
10	E5S407135	0.36	0.32	0.01	0.03
11	E5S407134	0.27	0.51	0.01	0.03
12	E5S407132	0.66	0.87	0.01	0.03
13	E5S407130	1.41	1.49	0.01	0.03
14	E5W03064	-1.24	-1.14	0.01	0.04
15	E5W03062	-0.95	-0.55	0.01	0.03
16	NEW085001-08552	0.72	0.66	0.01	0.03
17	NEW085000-08552	-0.50	-0.05	0.01	0.03
18	E5S40734	-0.10	0.05	0.01	0.03
19	E5S40727	0.20	0.07	0.01	0.03
20	NEW086006-08650	0.31	0.27	0.03	0.01
21	NEW086000-08650	0.95	0.72	0.03	0.01
22	NEW086001-08650	0.67	0.11	0.03	0.01
23	E6W03129	0.33	-0.18	0.03	0.01
24	NEW086008-08651	1.37	1.12	0.03	0.01
25	NEW086015-08651	0.35	-0.03	0.03	0.01
26	NEW086013-08651	-0.06	-0.68	0.03	0.01
27	NEW086009-08651	0.13	-0.35	0.03	0.01
28	E600307W000	0.25	-0.18	0.03	0.01
29	NEW086020-08652	0.37	0.48	0.03	0.01
30	NEW086022-08652	1.49	1.25	0.03	0.01
31	NEW086019-08652	0.16	-0.13	0.03	0.01
32	NEW086024-08652	-1.01	-1.31	0.03	0.01
33	E600406W1	-0.37	-0.35	0.03	0.01
34	E61135995	-0.76	-1.03	0.03	0.01
35	E600405W02	1.81	1.67	0.03	0.01
36	E6W04191916	-1.48	-1.88	0.04	0.01
37	E600402W1	0.06	-0.28	0.03	0.01
38	E6W03132	-0.80	-0.97	0.03	0.01
39	E61135998	0.36	0.34	0.03	0.01
Mean		0.07	0.01		

Unweighted Link Constant 0.066
Unweighted Link S.E. 0.005

Weighted Link Constant 0.058
Weighted Link S.E. 0.005

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW085008-08550	-0.84	-0.38	0.01	0.02	-17.06	-0.46
2	NEW085012-08550	1.82	1.63	0.01	0.03	6.21	0.18
3	NEW085010-08550	-0.24	0.08	0.01	0.02	-12.31	-0.32
4	NEW085011-08550	-1.91	-1.09	0.01	0.03	-26.59	-0.82
5	NEW085015-08551	2.25	2.04	0.01	0.03	6.35	0.22
6	NEW085021-08551	-1.00	-0.52	0.01	0.03	-14.26	-0.48
7	NEW085017-08551	0.36	0.61	0.01	0.03	-8.37	-0.25
8	E500502W1	-1.69	-1.42	0.01	0.04	-6.44	-0.27
9	E51135577	-0.90	-0.96	0.01	0.03	2.03	0.06

10	E5S407135	0.36	0.39	0.01	0.03	-1.08	-0.03
11	E5S407134	0.27	0.57	0.01	0.03	-10.01	-0.30
12	E5S407132	0.66	0.94	0.01	0.03	-9.43	-0.28
13	E5S407130	1.41	1.56	0.01	0.03	-4.58	-0.14
14	E5W03064	-1.24	-1.08	0.01	0.04	-4.19	-0.16
15	E5W03062	-0.95	-0.49	0.01	0.03	-16.81	-0.46
16	NEW085001-08552	0.72	0.72	0.01	0.03	-0.17	-0.01
17	NEW085000-08552	-0.50	0.01	0.01	0.03	-16.15	-0.51
18	E5S40734	-0.10	0.12	0.01	0.03	-7.02	-0.22
19	E5S40727	0.20	0.13	0.01	0.03	2.18	0.07
20	NEW086006-08650	0.31	0.34	0.03	0.01	-1.05	-0.03
21	NEW086000-08650	0.95	0.78	0.03	0.01	5.57	0.17
22	NEW086001-08650	0.67	0.17	0.03	0.01	16.67	0.50
23	E6W03129	0.33	-0.11	0.03	0.01	14.69	0.44
24	NEW086008-08651	1.37	1.19	0.03	0.01	6.04	0.19
25	NEW086015-08651	0.35	0.04	0.03	0.01	10.40	0.31
26	NEW086013-08651	-0.06	-0.62	0.03	0.01	17.96	0.55
27	NEW086009-08651	0.13	-0.29	0.03	0.01	13.70	0.41
28	E600307W000	0.25	-0.11	0.03	0.01	11.98	0.36
29	NEW086020-08652	0.37	0.54	0.03	0.01	-5.67	-0.17
30	NEW086022-08652	1.49	1.32	0.03	0.01	5.61	0.18
31	NEW086019-08652	0.16	-0.06	0.03	0.01	7.29	0.22
32	NEW086024-08652	-1.01	-1.24	0.03	0.01	6.33	0.23
33	E600406W1	-0.37	-0.29	0.03	0.01	-2.54	-0.08
34	E61135995	-0.76	-0.96	0.03	0.01	6.01	0.21
35	E600405W02	1.81	1.74	0.03	0.01	2.08	0.07
36	E6W04191916	-1.48	-1.82	0.04	0.01	8.09	0.33
37	E600402W1	0.06	-0.21	0.03	0.01	8.99	0.27
38	E6W03132	-0.80	-0.90	0.03	0.01	2.87	0.10
39	E61135998	0.36	0.41	0.03	0.01	-1.68	-0.05

t-test value for exclusion 1.5
Number of items included 3
Revised Unweighted Link Constant 0.043
Revised Unweighted Link S.E. 0.017

t-test value for exclusion 2.0
Number of items included 4
Revised Unweighted Link Constant 0.036
Revised Unweighted Link S.E. 0.015

t-test value for exclusion 3.0
Number of items included 9
Revised Unweighted Link Constant 0.076
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 4.0
Number of items included 9
Revised Unweighted Link Constant 0.076
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 11
Revised Unweighted Link Constant 0.047
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW085008-08550	-0.84	-0.38	0.01	0.02	-16.79
2	NEW085012-08550	1.82	1.62	0.01	0.03	6.47
3	NEW085010-08550	-0.24	0.08	0.01	0.02	-12.02
4	NEW085011-08550	-1.91	-1.09	0.01	0.03	-26.34
5	NEW085015-08551	2.25	2.03	0.01	0.03	6.57
6	NEW085021-08551	-1.00	-0.53	0.01	0.03	-14.04

7	NEW085017-08551	0.36	0.60	0.01	0.03	-8.11
8	E500502W1	-1.69	-1.43	0.01	0.04	-6.27
9	E51135577	-0.90	-0.97	0.01	0.03	2.29
10	E5S407135	0.36	0.38	0.01	0.03	-0.84
11	E5S407134	0.27	0.57	0.01	0.03	-9.77
12	E5S407132	0.66	0.93	0.01	0.03	-9.18
13	E5S407130	1.41	1.55	0.01	0.03	-4.34
14	E5W03064	-1.24	-1.09	0.01	0.04	-3.99
15	E5W03062	-0.95	-0.49	0.01	0.03	-16.54
16	NEW085001-08552	0.72	0.72	0.01	0.03	0.08
17	NEW085000-08552	-0.50	0.00	0.01	0.03	-15.91
18	E5S40734	-0.10	0.11	0.01	0.03	-6.77
19	E5S40727	0.20	0.13	0.01	0.03	2.42
20	NEW086006-08650	0.31	0.33	0.03	0.01	-0.79
21	NEW086000-08650	0.95	0.77	0.03	0.01	5.82
22	NEW086001-08650	0.67	0.16	0.03	0.01	16.93
23	E6W03129	0.33	-0.12	0.03	0.01	14.94
24	NEW086008-08651	1.37	1.18	0.03	0.01	6.28
25	NEW086015-08651	0.35	0.03	0.03	0.01	10.65
26	NEW086013-08651	-0.06	-0.63	0.03	0.01	18.20
27	NEW086009-08651	0.13	-0.29	0.03	0.01	13.95
28	E600307W000	0.25	-0.12	0.03	0.01	12.23
29	NEW086020-08652	0.37	0.54	0.03	0.01	-5.42
30	NEW086022-08652	1.49	1.31	0.03	0.01	5.84
31	NEW086019-08652	0.16	-0.07	0.03	0.01	7.54
32	NEW086024-08652	-1.01	-1.25	0.03	0.01	6.54
33	E600406W1	-0.37	-0.29	0.03	0.01	-2.30
34	E61135995	-0.76	-0.97	0.03	0.01	6.23
35	E600405W02	1.81	1.73	0.03	0.01	2.31
36	E6W04191916	-1.48	-1.82	0.04	0.01	8.27
37	E600402W1	0.06	-0.22	0.03	0.01	9.23
38	E6W03132	-0.80	-0.91	0.03	0.01	3.09
39	E61135998	0.36	0.40	0.03	0.01	-1.43

```
t-test value for exclusion         1.5
Number of items included             4
Revised Weighted Link Constant       0.036
Revised Weighted Link S.E.           0.015


t-test value for exclusion         2.0
Number of items included             4
Revised Weighted Link Constant       0.036
Revised Weighted Link S.E.           0.015


t-test value for exclusion         3.0
Number of items included             8
Revised Weighted Link Constant       0.065
Revised Weighted Link S.E.           0.011


t-test value for exclusion         4.0
Number of items included            10
Revised Weighted Link Constant       0.062
Revised Weighted Link S.E.           0.010


t-test value for exclusion         5.0
Number of items included            11
Revised Weighted Link Constant       0.050
Revised Weighted Link S.E.           0.009
```

Grade 6-7 Linking Results

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g6wvlif.txt No. of Items - 73
Input File 2 - g7wvlif.txt No. of Items - 73

No.	Bank ID	g6wvlif.t Diff 1	g7wvlif.t Diff 2	SE 1	SE 2
1	NEW086006-08650	0.27	0.16	0.01	0.02
2	NEW086000-08650	0.72	0.85	0.01	0.02
3	NEW086001-08650	0.11	0.24	0.01	0.02
4	NEW086008-08651	1.12	1.12	0.01	0.03
5	NEW086015-08651	-0.03	0.27	0.01	0.03
6	NEW086013-08651	-0.68	-0.38	0.01	0.03
7	NEW086009-08651	-0.35	-0.08	0.01	0.03
8	E61135995	-1.03	-0.87	0.01	0.03
9	E600406W1	-0.35	-0.27	0.01	0.03
10	E600405W02	1.67	1.50	0.01	0.03
11	NEW086020-08652	0.48	0.63	0.01	0.03
12	NEW086022-08652	1.25	1.13	0.01	0.03
13	NEW086019-08652	-0.13	0.24	0.01	0.03
14	NEW086024-08652	-1.31	-1.14	0.01	0.04
15	E6W03129	-0.18	0.04	0.01	0.02
16	E6W04191916	-1.88	-1.68	0.01	0.04
17	E600307W000	-0.18	-0.26	0.01	0.03
18	E600402W1	-0.28	-0.30	0.01	0.03
19	E61135998	0.34	0.40	0.01	0.03
20	E6W03132	-0.97	-1.08	0.01	0.04
21	NEW087022-08753	0.52	-0.03	0.03	0.01
22	NEW087017-08753	-0.17	-0.78	0.03	0.01
23	E700404W02	-0.23	-0.84	0.03	0.01
24	E7W03100	0.25	-0.05	0.03	0.01
25	E7W03103	-0.03	-0.05	0.03	0.01
26	NEW087011-08751	1.46	0.89	0.03	0.01
27	NEW087012-08751	-0.16	-0.42	0.03	0.01
28	NEW087015-08751	0.74	0.40	0.03	0.01
29	NEW087014-08751	1.43	1.04	0.03	0.01
30	NEW087013-08751	0.03	-0.26	0.03	0.01
31	E7W03098	0.34	0.16	0.03	0.01
32	NEW087004-08758	0.25	-0.15	0.03	0.01
33	NEW087003-08758	-0.27	-0.71	0.03	0.01
34	NEW087006-08758	-0.29	-0.79	0.03	0.01
35	NEW087005-08758	0.37	-0.28	0.03	0.01
36	E7S407103	0.07	-0.29	0.03	0.01
37	E7S407104	1.07	0.92	0.03	0.01
38	E7S40773	0.88	0.66	0.03	0.01
39	E7S40775	0.96	0.58	0.03	0.01
40	E7S40782	0.75	0.65	0.03	0.01
Mean		0.16	0.03		

Unweighted Link Constant	0.136
Unweighted Link S.E.	0.005
Weighted Link Constant	0.137
Weighted Link S.E.	0.005

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW086006-08650	0.27	0.29	0.01	0.02	-0.75	-0.02
2	NEW086000-08650	0.72	0.99	0.01	0.02	-10.16	-0.27
3	NEW086001-08650	0.11	0.37	0.01	0.02	-10.29	-0.27
4	NEW086008-08651	1.12	1.25	0.01	0.03	-4.27	-0.13
5	NEW086015-08651	-0.03	0.41	0.01	0.03	-14.28	-0.44
6	NEW086013-08651	-0.68	-0.24	0.01	0.03	-13.22	-0.44
7	NEW086009-08651	-0.35	0.05	0.01	0.03	-12.78	-0.41
8	E61135995	-1.03	-0.73	0.01	0.03	-8.05	-0.29

9	E600406W1	-0.35	-0.14	0.01	0.03	-6.60	-0.22
10	E600405W02	1.67	1.63	0.01	0.03	1.28	0.04
11	NEW086020-08652	0.48	0.77	0.01	0.03	-9.70	-0.29
12	NEW086022-08652	1.25	1.26	0.01	0.03	-0.48	-0.01
13	NEW086019-08652	-0.13	0.37	0.01	0.03	-16.17	-0.50
14	NEW086024-08652	-1.31	-1.01	0.01	0.04	-7.59	-0.30
15	E6W03129	-0.18	0.17	0.01	0.02	-13.27	-0.35
16	E6W04191916	-1.88	-1.55	0.01	0.04	-7.31	-0.34
17	E600307W000	-0.18	-0.13	0.01	0.03	-1.46	-0.05
18	E600402W1	-0.28	-0.17	0.01	0.03	-3.26	-0.11
19	E61135998	0.34	0.53	0.01	0.03	-6.19	-0.19
20	E6W03132	-0.97	-0.94	0.01	0.04	-0.71	-0.03
21	NEW087022-08753	0.52	0.11	0.03	0.01	13.71	0.41
22	NEW087017-08753	-0.17	-0.65	0.03	0.01	14.90	0.48
23	E700404W02	-0.23	-0.71	0.03	0.01	14.82	0.48
24	E7W03100	0.25	0.09	0.03	0.01	5.43	0.17
25	E7W03103	-0.03	0.09	0.03	0.01	-3.95	-0.12
26	NEW087011-08751	1.46	1.03	0.03	0.01	13.69	0.43
27	NEW087012-08751	-0.16	-0.28	0.03	0.01	3.86	0.12
28	NEW087015-08751	0.74	0.54	0.03	0.01	6.59	0.20
29	NEW087014-08751	1.43	1.18	0.03	0.01	8.21	0.26
30	NEW087013-08751	0.03	-0.12	0.03	0.01	4.85	0.15
31	E7W03098	0.34	0.29	0.03	0.01	1.52	0.05
32	NEW087004-08758	0.25	-0.02	0.03	0.01	8.86	0.27
33	NEW087003-08758	-0.27	-0.58	0.03	0.01	9.49	0.31
34	NEW087006-08758	-0.29	-0.65	0.03	0.01	11.31	0.37
35	NEW087005-08758	0.37	-0.14	0.03	0.01	17.10	0.52
36	E7S407103	0.07	-0.15	0.03	0.01	7.17	0.22
37	E7S407104	1.07	1.06	0.03	0.01	0.44	0.01
38	E7S40773	0.88	0.80	0.03	0.01	2.76	0.08
39	E7S40775	0.96	0.72	0.03	0.01	8.14	0.24
40	E7S40782	0.75	0.78	0.03	0.01	-1.10	-0.03

t-test value for exclusion 1.5
Number of items included 7
Revised Unweighted Link Constant 0.123
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 2.0
Number of items included 8
Revised Unweighted Link Constant 0.130
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 3.0
Number of items included 9
Revised Unweighted Link Constant 0.140
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 4.0
Number of items included 12
Revised Unweighted Link Constant 0.130
Revised Unweighted Link S.E. 0.009

t-test value for exclusion 5.0
Number of items included 14
Revised Unweighted Link Constant 0.132
Revised Unweighted Link S.E. 0.008

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW086006-08650	0.27	0.29	0.01	0.02	-0.82
2	NEW086000-08650	0.72	0.99	0.01	0.02	-10.22
3	NEW086001-08650	0.11	0.38	0.01	0.02	-10.36
4	NEW086008-08651	1.12	1.25	0.01	0.03	-4.33

5	NEW086015-08651	-0.03	0.41	0.01	0.03	-14.34
6	NEW086013-08651	-0.68	-0.24	0.01	0.03	-13.28
7	NEW086009-08651	-0.35	0.06	0.01	0.03	-12.84
8	E61135995	-1.03	-0.73	0.01	0.03	-8.10
9	E600406W1	-0.35	-0.13	0.01	0.03	-6.66
10	E600405W02	1.67	1.63	0.01	0.03	1.22
11	NEW086020-08652	0.48	0.77	0.01	0.03	-9.76
12	NEW086022-08652	1.25	1.27	0.01	0.03	-0.54
13	NEW086019-08652	-0.13	0.37	0.01	0.03	-16.23
14	NEW086024-08652	-1.31	-1.01	0.01	0.04	-7.64
15	E6W03129	-0.18	0.17	0.01	0.02	-13.33
16	E6W04191916	-1.88	-1.54	0.01	0.04	-7.34
17	E600307W000	-0.18	-0.13	0.01	0.03	-1.52
18	E600402W1	-0.28	-0.17	0.01	0.03	-3.31
19	E61135998	0.34	0.53	0.01	0.03	-6.24
20	E6W03132	-0.97	-0.94	0.01	0.04	-0.76
21	NEW087022-08753	0.52	0.11	0.03	0.01	13.65
22	NEW087017-08753	-0.17	-0.64	0.03	0.01	14.85
23	E700404W02	-0.23	-0.71	0.03	0.01	14.76
24	E7W03100	0.25	0.09	0.03	0.01	5.37
25	E7W03103	-0.03	0.09	0.03	0.01	-4.01
26	NEW087011-08751	1.46	1.03	0.03	0.01	13.63
27	NEW087012-08751	-0.16	-0.28	0.03	0.01	3.80
28	NEW087015-08751	0.74	0.54	0.03	0.01	6.53
29	NEW087014-08751	1.43	1.18	0.03	0.01	8.15
30	NEW087013-08751	0.03	-0.12	0.03	0.01	4.79
31	E7W03098	0.34	0.29	0.03	0.01	1.46
32	NEW087004-08758	0.25	-0.01	0.03	0.01	8.80
33	NEW087003-08758	-0.27	-0.58	0.03	0.01	9.44
34	NEW087006-08758	-0.29	-0.65	0.03	0.01	11.25
35	NEW087005-08758	0.37	-0.14	0.03	0.01	17.04
36	E7S407103	0.07	-0.15	0.03	0.01	7.11
37	E7S407104	1.07	1.06	0.03	0.01	0.38
38	E7S40773	0.88	0.80	0.03	0.01	2.70
39	E7S40775	0.96	0.72	0.03	0.01	8.08
40	E7S40782	0.75	0.78	0.03	0.01	-1.16

t-test value for exclusion 1.5
Number of items included 7
Revised Weighted Link Constant 0.136
Revised Weighted Link S.E. 0.011

t-test value for exclusion 2.0
Number of items included 8
Revised Weighted Link Constant 0.131
Revised Weighted Link S.E. 0.011

t-test value for exclusion 3.0
Number of items included 9
Revised Weighted Link Constant 0.141
Revised Weighted Link S.E. 0.010

t-test value for exclusion 4.0
Number of items included 11
Revised Weighted Link Constant 0.142
Revised Weighted Link S.E. 0.009

t-test value for exclusion 5.0
Number of items included 14
Revised Weighted Link Constant 0.133
Revised Weighted Link S.E. 0.008

Grade 7-8 Linking Results

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g7wvlif.txt No. of Items - 73
Input File 2 - g8wvlif.txt No. of Items - 49

No.	Bank ID	g7wvlif.t Diff 1	g8wvlif.t Diff 2	SE 1	SE 2
1	NEW087022-08753	-0.03	0.31	0.01	0.02
2	NEW087017-08753	-0.78	-0.46	0.01	0.02
3	E7W03098	0.16	0.20	0.01	0.02
4	E7W03103	-0.05	-0.06	0.01	0.02
5	NEW087004-08758	-0.15	0.26	0.01	0.02
6	NEW087003-08758	-0.71	-0.56	0.01	0.02
7	NEW087006-08758	-0.79	-0.40	0.01	0.02
8	NEW087005-08758	-0.28	0.10	0.01	0.02
9	E700404W02	-0.84	-0.55	0.01	0.02
10	E7S407103	-0.29	-0.32	0.01	0.02
11	E7S407104	0.92	0.95	0.01	0.02
12	NEW087011-08751	0.89	0.90	0.01	0.02
13	NEW087012-08751	-0.42	-0.32	0.01	0.02
14	NEW087015-08751	0.40	0.62	0.01	0.02
15	NEW087014-08751	1.04	1.32	0.01	0.02
16	NEW087013-08751	-0.26	-0.07	0.01	0.02
17	E7W03100	-0.05	0.02	0.01	0.02
18	E7S40773	0.66	0.45	0.01	0.02
19	E7S40775	0.58	0.58	0.01	0.02
20	E7S40782	0.65	0.62	0.01	0.02
21	NEW088019-08853	1.71	1.43	0.03	0.01
22	NEW088017-08853	0.08	-0.32	0.03	0.01
23	E8W03137	0.70	0.19	0.03	0.01
24	E8S407127	0.55	0.16	0.03	0.01
25	NEW088013-08850	0.65	0.05	0.03	0.01
26	NEW088011-08850	-0.89	-1.27	0.03	0.01
27	NEW088008-08850	2.29	1.65	0.03	0.01
28	NEW088010-08850	0.92	0.80	0.03	0.01
29	NEW088006-08851	-0.15	-0.53	0.03	0.01
30	NEW088001-08851	-1.34	-1.90	0.04	0.02
31	NEW088003-08851	0.65	0.33	0.03	0.01
32	NEW088000-08851	0.72	0.36	0.03	0.01
33	NEW088007-08851	1.20	0.66	0.03	0.01
34	E8S407126	1.72	1.03	0.03	0.01
35	E8S40778	-0.33	-0.55	0.03	0.01
36	E8S40781	1.56	1.63	0.03	0.01
37	E81135586	-1.23	-1.75	0.04	0.02
38	E81135589	-0.99	-1.44	0.04	0.01
39	E81135585	0.49	0.36	0.03	0.01
Mean		0.23	0.12		

Unweighted Link Constant 0.115
Unweighted Link S.E. 0.004

Weighted Link Constant 0.023
Weighted Link S.E. 0.004

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW087022-08753	-0.03	0.42	0.01	0.02	-21.45	-0.45
2	NEW087017-08753	-0.78	-0.35	0.01	0.02	-18.97	-0.43
3	E7W03098	0.16	0.32	0.01	0.02	-7.17	-0.16
4	E7W03103	-0.05	0.05	0.01	0.02	-4.31	-0.10
5	NEW087004-08758	-0.15	0.38	0.01	0.02	-23.31	-0.53
6	NEW087003-08758	-0.71	-0.45	0.01	0.02	-10.27	-0.26
7	NEW087006-08758	-0.79	-0.29	0.01	0.02	-20.04	-0.50
8	NEW087005-08758	-0.28	0.22	0.01	0.02	-21.46	-0.50
9	E700404W02	-0.84	-0.43	0.01	0.02	-17.82	-0.41

10	E7S407103	-0.29	-0.21	0.01	0.02	-3.28	-0.08
11	E7S407104	0.92	1.06	0.01	0.02	-6.38	-0.14
12	NEW087011-08751	0.89	1.01	0.01	0.02	-5.50	-0.12
13	NEW087012-08751	-0.42	-0.20	0.01	0.02	-8.82	-0.21
14	NEW087015-08751	0.40	0.74	0.01	0.02	-15.17	-0.34
15	NEW087014-08751	1.04	1.43	0.01	0.02	-17.28	-0.39
16	NEW087013-08751	-0.26	0.04	0.01	0.02	-12.72	-0.30
17	E7W03100	-0.05	0.14	0.01	0.02	-8.73	-0.19
18	E7S40773	0.66	0.57	0.01	0.02	4.09	0.09
19	E7S40775	0.58	0.69	0.01	0.02	-4.92	-0.11
20	E7S40782	0.65	0.74	0.01	0.02	-4.24	-0.09
21	NEW088019-08853	1.71	1.54	0.03	0.01	5.23	0.17
22	NEW088017-08853	0.08	-0.20	0.03	0.01	8.97	0.28
23	E8W03137	0.70	0.30	0.03	0.01	13.12	0.40
24	E8S407127	0.55	0.27	0.03	0.01	9.05	0.27
25	NEW088013-08850	0.65	0.16	0.03	0.01	16.22	0.49
26	NEW088011-08850	-0.89	-1.15	0.03	0.01	7.18	0.27
27	NEW088008-08850	2.29	1.76	0.03	0.01	15.16	0.53
28	NEW088010-08850	0.92	0.91	0.03	0.01	0.22	0.01
29	NEW088006-08851	-0.15	-0.41	0.03	0.01	8.07	0.26
30	NEW088001-08851	-1.34	-1.78	0.04	0.02	10.42	0.44
31	NEW088003-08851	0.65	0.45	0.03	0.01	6.72	0.20
32	NEW088000-08851	0.72	0.47	0.03	0.01	8.15	0.24
33	NEW088007-08851	1.20	0.78	0.03	0.01	14.07	0.43
34	E8S407126	1.72	1.15	0.03	0.01	17.90	0.57
35	E8S40778	-0.33	-0.43	0.03	0.01	3.26	0.11
36	E8S40781	1.56	1.75	0.03	0.01	-5.87	-0.18
37	E81135586	-1.23	-1.63	0.04	0.02	9.71	0.40
38	E81135589	-0.99	-1.32	0.04	0.01	8.69	0.33
39	E81135585	0.49	0.47	0.03	0.01	0.76	0.02

t-test value for exclusion 1.5
Number of items included 2
Revised Unweighted Link Constant 0.129
Revised Unweighted Link S.E. 0.021

t-test value for exclusion 2.0
Number of items included 2
Revised Unweighted Link Constant 0.129
Revised Unweighted Link S.E. 0.021

t-test value for exclusion 3.0
Number of items included 2
Revised Unweighted Link Constant 0.129
Revised Unweighted Link S.E. 0.021

t-test value for exclusion 4.0
Number of items included 4
Revised Unweighted Link Constant 0.129
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 5.0
Number of items included 8
Revised Unweighted Link Constant 0.095
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW087022-08753	-0.03	0.33	0.01	0.02	-17.09
2	NEW087017-08753	-0.78	-0.44	0.01	0.02	-14.95
3	E7W03098	0.16	0.23	0.01	0.02	-3.14
4	E7W03103	-0.05	-0.04	0.01	0.02	-0.40
5	NEW087004-08758	-0.15	0.29	0.01	0.02	-19.29
6	NEW087003-08758	-0.71	-0.54	0.01	0.02	-6.70

7	NEW087006-08758	-0.79	-0.38	0.01	0.02	-16.40
8	NEW087005-08758	-0.28	0.12	0.01	0.02	-17.50
9	E700404W02	-0.84	-0.52	0.01	0.02	-13.87
10	E7S407103	-0.29	-0.30	0.01	0.02	0.50
11	E7S407104	0.92	0.97	0.01	0.02	-2.22
12	NEW087011-08751	0.89	0.92	0.01	0.02	-1.38
13	NEW087012-08751	-0.42	-0.30	0.01	0.02	-5.07
14	NEW087015-08751	0.40	0.65	0.01	0.02	-11.05
15	NEW087014-08751	1.04	1.34	0.01	0.02	-13.22
16	NEW087013-08751	-0.26	-0.05	0.01	0.02	-8.84
17	E7W03100	-0.05	0.05	0.01	0.02	-4.42
18	E7S40773	0.66	0.48	0.01	0.02	8.22
19	E7S40775	0.58	0.60	0.01	0.02	-0.77
20	E7S40782	0.65	0.65	0.01	0.02	-0.09
21	NEW088019-08853	1.71	1.45	0.03	0.01	8.07
22	NEW088017-08853	0.08	-0.29	0.03	0.01	11.88
23	E8W03137	0.70	0.21	0.03	0.01	16.14
24	E8S407127	0.55	0.18	0.03	0.01	12.06
25	NEW088013-08850	0.65	0.07	0.03	0.01	19.27
26	NEW088011-08850	-0.89	-1.24	0.03	0.01	9.64
27	NEW088008-08850	2.29	1.67	0.03	0.01	17.77
28	NEW088010-08850	0.92	0.82	0.03	0.01	3.28
29	NEW088006-08851	-0.15	-0.50	0.03	0.01	10.93
30	NEW088001-08851	-1.34	-1.87	0.04	0.02	12.60
31	NEW088003-08851	0.65	0.36	0.03	0.01	9.78
32	NEW088000-08851	0.72	0.38	0.03	0.01	11.21
33	NEW088007-08851	1.20	0.69	0.03	0.01	17.09
34	E8S407126	1.72	1.06	0.03	0.01	20.76
35	E8S40778	-0.33	-0.52	0.03	0.01	6.04
36	E8S40781	1.56	1.65	0.03	0.01	-2.95
37	E81135586	-1.23	-1.72	0.04	0.02	11.94
38	E81135589	-0.99	-1.41	0.04	0.01	11.08
39	E81135585	0.49	0.38	0.03	0.01	3.79

t-test value for exclusion 1.5
Number of items included 5
Revised Weighted Link Constant 0.013
Revised Weighted Link S.E. 0.010

t-test value for exclusion 2.0
Number of items included 5
Revised Weighted Link Constant 0.013
Revised Weighted Link S.E. 0.010

t-test value for exclusion 3.0
Number of items included 7
Revised Weighted Link Constant 0.000
Revised Weighted Link S.E. 0.009

t-test value for exclusion 4.0
Number of items included 10
Revised Weighted Link Constant 0.012
Revised Weighted Link S.E. 0.008

t-test value for exclusion 5.0
Number of items included 11
Revised Weighted Link Constant 0.002
Revised Weighted Link S.E. 0.007

Appendix 2

Grade 3-4 Linking Results – Tested Higher Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g3wvlif.txt No. of Items - 49
Input File 2 - g4wvlif.txt No. of Items - 73

No.	Bank ID	g3wvlif.t Diff 1	g4wvlif.t Diff 2	SE 1	SE 2
1	NEW083002-08350	-0.24	0.31	0.01	0.02
2	NEW083006-08350	2.22	1.90	0.01	0.03
3	NEW083003-08350	-0.55	-0.32	0.01	0.02
4	NEW083027-08353	0.24	0.54	0.01	0.03
5	NEW083029-08353	0.43	0.72	0.01	0.03
6	E300404W02	0.84	0.94	0.01	0.02
7	E301203W000	0.56	0.83	0.01	0.03
8	NEW083007-08352	0.56	0.38	0.01	0.03
9	E3S40713	0.48	0.39	0.01	0.02
10	E3S40714	-1.65	-1.47	0.01	0.04
11	E31135347	-0.67	-0.84	0.01	0.03
12	E3S40706	-1.00	-1.10	0.01	0.04
13	E3S40703	0.84	0.90	0.01	0.03
14	E3S40704	0.93	1.00	0.01	0.03
15	NEW083017-08351	0.90	0.97	0.01	0.03
16	NEW083015-08351	0.07	0.01	0.01	0.03
17	NEW083020-08351	0.07	-0.06	0.01	0.03
18	E3S40710	-1.05	-0.96	0.01	0.04
19	E300405W02	0.37	0.69	0.01	0.02
Mean		0.18	0.25		

Unweighted Link Constant -0.078
Unweighted Link S.E. 0.007

Weighted Link Constant -0.098
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW083002-08350	-0.24	0.24	0.01	0.02	-18.37	-0.47
2	NEW083006-08350	2.22	1.82	0.01	0.03	13.22	0.40
3	NEW083003-08350	-0.55	-0.40	0.01	0.02	-5.92	-0.16
4	NEW083027-08353	0.24	0.47	0.01	0.03	-7.45	-0.22
5	NEW083029-08353	0.43	0.65	0.01	0.03	-7.19	-0.21
6	E300404W02	0.84	0.86	0.01	0.02	-0.71	-0.02
7	E301203W000	0.56	0.75	0.01	0.03	-6.41	-0.19
8	NEW083007-08352	0.56	0.30	0.01	0.03	8.56	0.26
9	E3S40713	0.48	0.31	0.01	0.02	6.62	0.17
10	E3S40714	-1.65	-1.55	0.01	0.04	-2.35	-0.10
11	E31135347	-0.67	-0.92	0.01	0.03	6.84	0.24
12	E3S40706	-1.00	-1.18	0.01	0.04	4.80	0.18
13	E3S40703	0.84	0.82	0.01	0.03	0.70	0.02
14	E3S40704	0.93	0.92	0.01	0.03	0.15	0.00
15	NEW083017-08351	0.90	0.90	0.01	0.03	0.17	0.01
16	NEW083015-08351	0.07	-0.07	0.01	0.03	4.32	0.14
17	NEW083020-08351	0.07	-0.14	0.01	0.03	6.63	0.21
18	E3S40710	-1.05	-1.04	0.01	0.04	-0.31	-0.01
19	E300405W02	0.37	0.61	0.01	0.02	-9.48	-0.24

t-test value for exclusion 1.5
Number of items included 5
Revised Unweighted Link Constant -0.078
Revised Unweighted Link S.E. 0.013

```
t-test value for exclusion         2.0
Number of items included             5
Revised Unweighted Link Constant    -0.078
Revised Unweighted Link S.E.         0.013


t-test value for exclusion         3.0
Number of items included             6
Revised Unweighted Link Constant    -0.094
Revised Unweighted Link S.E.         0.013


t-test value for exclusion         4.0
Number of items included             6
Revised Unweighted Link Constant    -0.094
Revised Unweighted Link S.E.         0.013


t-test value for exclusion         5.0
Number of items included             8
Revised Unweighted Link Constant    -0.050
Revised Unweighted Link S.E.         0.011


Linked Item Difficulties - Weighted Link Constant

  No.   Bank ID             Diff 1   Diff 2  SE 1   SE 2   t-test
    1   NEW083002-08350     -0.24     0.22   0.01   0.02   -17.58
    2   NEW083006-08350      2.22     1.80   0.01   0.03    13.89
    3   NEW083003-08350     -0.55    -0.42   0.01   0.02    -5.15
    4   NEW083027-08353      0.24     0.45   0.01   0.03    -6.78
    5   NEW083029-08353      0.43     0.63   0.01   0.03    -6.51
    6   E300404W02           0.84     0.84   0.01   0.02     0.06
    7   E301203W000          0.56     0.73   0.01   0.03    -5.74
    8   NEW083007-08352      0.56     0.28   0.01   0.03     9.23
    9   E3S40713             0.48     0.29   0.01   0.02     7.41
   10   E3S40714            -1.65    -1.57   0.01   0.04    -1.88
   11   E31135347           -0.67    -0.94   0.01   0.03     7.40
   12   E3S40706            -1.00    -1.20   0.01   0.04     5.33
   13   E3S40703             0.84     0.80   0.01   0.03     1.37
   14   E3S40704             0.93     0.90   0.01   0.03     0.81
   15   NEW083017-08351      0.90     0.88   0.01   0.03     0.84
   16   NEW083015-08351      0.07    -0.09   0.01   0.03     4.97
   17   NEW083020-08351      0.07    -0.16   0.01   0.03     7.27
   18   E3S40710            -1.05    -1.06   0.01   0.04     0.24
   19   E300405W02           0.37     0.59   0.01   0.02    -8.70


t-test value for exclusion         1.5
Number of items included             5
Revised Weighted Link Constant      -0.078
Revised Weighted Link S.E.           0.013


t-test value for exclusion         2.0
Number of items included             6
Revised Weighted Link Constant      -0.087
Revised Weighted Link S.E.           0.013


t-test value for exclusion         3.0
Number of items included             6
Revised Weighted Link Constant      -0.087
Revised Weighted Link S.E.           0.013


t-test value for exclusion         4.0
Number of items included             6
Revised Weighted Link Constant      -0.087
Revised Weighted Link S.E.           0.013
```

```
t-test value for exclusion         5.0
Number of items included             7
Revised Weighted Link Constant      -0.066
Revised Weighted Link S.E.           0.012
```

Grade 3-4 Linking Results – Tested Lower Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g3wvlif.txt No. of Items - 49
Input File 2 - g4wvlif.txt No. of Items - 73

No.	Bank ID	g3wvlif.t Diff 1	g4wvlif.t Diff 2	SE 1	SE 2
1	NEW084007-08450	-0.44	-0.98	0.02	0.01
2	NEW084009-08450	0.06	-0.61	0.02	0.01
3	E4S40710	-0.31	-0.86	0.02	0.01
4	E4S40751	0.79	0.47	0.02	0.01
5	E4S40753	0.89	0.77	0.02	0.01
6	E4S40755	-0.63	-0.75	0.02	0.01
7	NEW084020-08451	0.30	-0.21	0.02	0.01
8	NEW084023-08451	0.62	0.32	0.02	0.01
9	NEW084025-08451	1.02	0.56	0.02	0.01
10	NEW084016-08454	0.22	-0.03	0.02	0.01
11	NEW084018-08454	0.81	1.04	0.02	0.01
12	NEW084013-08454	0.47	-0.14	0.02	0.01
13	NEW084015-08454	0.45	-0.33	0.02	0.01
14	E4W03067	-0.50	-0.86	0.02	0.01
15	E400905W1	-0.20	-0.60	0.02	0.01
16	NEW084000-08453	-0.17	-0.23	0.02	0.01
17	NEW084004-08453	0.65	0.00	0.02	0.01
18	NEW084001-08453	1.05	0.67	0.02	0.01
19	E400505W1	-0.47	-1.08	0.02	0.01
20	E400605W1	0.53	0.50	0.02	0.01
Mean		0.26	-0.12		

Unweighted Link Constant 0.372
Unweighted Link S.E. 0.005

Weighted Link Constant 0.374
Weighted Link S.E. 0.005

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW084007-08450	-0.44	-0.61	0.02	0.01	8.01	0.18
2	NEW084009-08450	0.06	-0.24	0.02	0.01	14.03	0.29
3	E4S40710	-0.31	-0.49	0.02	0.01	8.06	0.17
4	E4S40751	0.79	0.84	0.02	0.01	-2.55	-0.06
5	E4S40753	0.89	1.14	0.02	0.01	-11.51	-0.25
6	E4S40755	-0.63	-0.38	0.02	0.01	-10.61	-0.26
7	NEW084020-08451	0.30	0.16	0.02	0.01	6.40	0.14
8	NEW084023-08451	0.62	0.69	0.02	0.01	-3.21	-0.07
9	NEW084025-08451	1.02	0.93	0.02	0.01	3.97	0.09
10	NEW084016-08454	0.22	0.34	0.02	0.01	-5.46	-0.12
11	NEW084018-08454	0.81	1.42	0.02	0.01	-27.69	-0.61
12	NEW084013-08454	0.47	0.23	0.02	0.01	10.57	0.23
13	NEW084015-08454	0.45	0.04	0.02	0.01	18.35	0.41
14	E4W03067	-0.50	-0.49	0.02	0.01	-0.71	-0.02
15	E400905W1	-0.20	-0.23	0.02	0.01	1.00	0.02
16	NEW084000-08453	-0.17	0.15	0.02	0.01	-14.25	-0.32
17	NEW084004-08453	0.65	0.37	0.02	0.01	12.62	0.28
18	NEW084001-08453	1.05	1.05	0.02	0.01	0.08	0.00
19	E400505W1	-0.47	-0.71	0.02	0.01	9.65	0.23
20	E400605W1	0.53	0.87	0.02	0.01	-15.83	-0.34

t-test value for exclusion 1.5
Number of items included 3
Revised Unweighted Link Constant 0.375
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 2.0
Number of items included 3
Revised Unweighted Link Constant 0.375
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 4
Revised Unweighted Link Constant 0.360
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 6
Revised Unweighted Link Constant 0.367
Revised Unweighted Link S.E. 0.009

t-test value for exclusion 5.0
Number of items included 6
Revised Unweighted Link Constant 0.367
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW084007-08450	-0.44	-0.61	0.02	0.01	7.92
2	NEW084009-08450	0.06	-0.23	0.02	0.01	13.93
3	E4S40710	-0.31	-0.48	0.02	0.01	7.97
4	E4S40751	0.79	0.84	0.02	0.01	-2.65
5	E4S40753	0.89	1.15	0.02	0.01	-11.61
6	E4S40755	-0.63	-0.38	0.02	0.01	-10.70
7	NEW084020-08451	0.30	0.16	0.02	0.01	6.30
8	NEW084023-08451	0.62	0.69	0.02	0.01	-3.30
9	NEW084025-08451	1.02	0.94	0.02	0.01	3.88
10	NEW084016-08454	0.22	0.35	0.02	0.01	-5.55
11	NEW084018-08454	0.81	1.42	0.02	0.01	-27.79
12	NEW084013-08454	0.47	0.24	0.02	0.01	10.48
13	NEW084015-08454	0.45	0.04	0.02	0.01	18.25
14	E4W03067	-0.50	-0.48	0.02	0.01	-0.79
15	E400905W1	-0.20	-0.22	0.02	0.01	0.91
16	NEW084000-08453	-0.17	0.15	0.02	0.01	-14.34
17	NEW084004-08453	0.65	0.38	0.02	0.01	12.53
18	NEW084001-08453	1.05	1.05	0.02	0.01	-0.01
19	E400505W1	-0.47	-0.70	0.02	0.01	9.57
20	E400605W1	0.53	0.87	0.02	0.01	-15.92

t-test value for exclusion 1.5
Number of items included 3
Revised Weighted Link Constant 0.375
Revised Weighted Link S.E. 0.013

t-test value for exclusion 2.0
Number of items included 3
Revised Weighted Link Constant 0.375
Revised Weighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 4
Revised Weighted Link Constant 0.359
Revised Weighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 6
Revised Weighted Link Constant 0.366
Revised Weighted Link S.E. 0.009

```
t-test value for exclusion         5.0
Number of items included             6
Revised Weighted Link Constant       0.366
Revised Weighted Link S.E.           0.009
```

Grade 4-5 Linking Results – Tested Higher Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g4wvlif.txt No. of Items - 73
Input File 2 - g5wvlif.txt No. of Items - 73

No.	Bank ID	g4wvlif.t Diff 1	g5wvlif.t Diff 2	SE 1	SE 2
1	NEW084007-08450	-0.98	-1.00	0.01	0.03
2	NEW084009-08450	-0.61	-0.71	0.01	0.02
3	E400505W1	-1.08	-1.53	0.01	0.04
4	E400605W1	0.50	0.27	0.01	0.03
5	NEW084016-08454	-0.03	-0.17	0.01	0.03
6	NEW084018-08454	1.04	0.96	0.01	0.03
7	NEW084013-08454	-0.14	-0.52	0.01	0.03
8	NEW084015-08454	-0.33	-0.42	0.01	0.03
9	NEW084000-08453	-0.23	-0.82	0.01	0.03
10	NEW084004-08453	0.00	-0.47	0.01	0.03
11	NEW084001-08453	0.67	0.29	0.01	0.03
12	E4S40751	0.47	0.05	0.01	0.03
13	E4S40753	0.77	0.25	0.01	0.03
14	E4S40755	-0.75	-0.96	0.01	0.03
15	NEW084020-08451	-0.21	-0.58	0.01	0.03
16	NEW084023-08451	0.32	-0.30	0.01	0.03
17	NEW084025-08451	0.56	-0.11	0.01	0.03
18	E4W03067	-0.86	-1.44	0.01	0.04
19	E400905W1	-0.60	-1.00	0.01	0.03
20	E4S40710	-0.86	-1.17	0.01	0.03
Mean		-0.12	-0.47		

Unweighted Link Constant 0.352
Unweighted Link S.E. 0.007

Weighted Link Constant 0.335
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW084007-08450	-0.98	-0.65	0.01	0.03	-11.72	-0.33
2	NEW084009-08450	-0.61	-0.36	0.01	0.02	-9.09	-0.25
3	E400505W1	-1.08	-1.18	0.01	0.04	2.42	0.10
4	E400605W1	0.50	0.62	0.01	0.03	-4.12	-0.12
5	NEW084016-08454	-0.03	0.19	0.01	0.03	-6.95	-0.22
6	NEW084018-08454	1.04	1.31	0.01	0.03	-8.93	-0.27
7	NEW084013-08454	-0.14	-0.17	0.01	0.03	0.84	0.03
8	NEW084015-08454	-0.33	-0.07	0.01	0.03	-8.07	-0.26
9	NEW084000-08453	-0.23	-0.47	0.01	0.03	7.25	0.25
10	NEW084004-08453	0.00	-0.12	0.01	0.03	3.89	0.12
11	NEW084001-08453	0.67	0.65	0.01	0.03	0.96	0.03
12	E4S40751	0.47	0.41	0.01	0.03	2.09	0.06
13	E4S40753	0.77	0.60	0.01	0.03	5.82	0.18
14	E4S40755	-0.75	-0.61	0.01	0.03	-4.08	-0.14
15	NEW084020-08451	-0.21	-0.23	0.01	0.03	0.57	0.02
16	NEW084023-08451	0.32	0.06	0.01	0.03	8.26	0.26
17	NEW084025-08451	0.56	0.25	0.01	0.03	10.23	0.32
18	E4W03067	-0.86	-1.08	0.01	0.04	5.72	0.23
19	E400905W1	-0.60	-0.64	0.01	0.03	1.32	0.05
20	E4S40710	-0.86	-0.81	0.01	0.03	-1.57	-0.05

t-test value for exclusion 1.5
Number of items included 4
Revised Unweighted Link Constant 0.382
Revised Unweighted Link S.E. 0.016

t-test value for exclusion 2.0
Number of items included 5
Revised Unweighted Link Constant 0.367
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 3.0
Number of items included 7
Revised Unweighted Link Constant 0.386
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 8
Revised Unweighted Link Constant 0.397
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 5.0
Number of items included 10
Revised Unweighted Link Constant 0.361
Revised Unweighted Link S.E. 0.010

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW084007-08450	-0.98	-0.67	0.01	0.03	-11.15
2	NEW084009-08450	-0.61	-0.38	0.01	0.02	-8.49
3	E400505W1	-1.08	-1.19	0.01	0.04	2.82
4	E400605W1	0.50	0.60	0.01	0.03	-3.58
5	NEW084016-08454	-0.03	0.17	0.01	0.03	-6.43
6	NEW084018-08454	1.04	1.29	0.01	0.03	-8.38
7	NEW084013-08454	-0.14	-0.18	0.01	0.03	1.34
8	NEW084015-08454	-0.33	-0.09	0.01	0.03	-7.57
9	NEW084000-08453	-0.23	-0.49	0.01	0.03	7.73
10	NEW084004-08453	0.00	-0.14	0.01	0.03	4.39
11	NEW084001-08453	0.67	0.63	0.01	0.03	1.51
12	E4S40751	0.47	0.39	0.01	0.03	2.62
13	E4S40753	0.77	0.58	0.01	0.03	6.36
14	E4S40755	-0.75	-0.62	0.01	0.03	-3.62
15	NEW084020-08451	-0.21	-0.24	0.01	0.03	1.07
16	NEW084023-08451	0.32	0.04	0.01	0.03	8.77
17	NEW084025-08451	0.56	0.23	0.01	0.03	10.75
18	E4W03067	-0.86	-1.10	0.01	0.04	6.13
19	E400905W1	-0.60	-0.66	0.01	0.03	1.78
20	E4S40710	-0.86	-0.83	0.01	0.03	-1.00

t-test value for exclusion 1.5
Number of items included 3
Revised Weighted Link Constant 0.348
Revised Weighted Link S.E. 0.018

t-test value for exclusion 2.0
Number of items included 5
Revised Weighted Link Constant 0.363
Revised Weighted Link S.E. 0.014

t-test value for exclusion 3.0
Number of items included 7
Revised Weighted Link Constant 0.380
Revised Weighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 9
Revised Weighted Link Constant 0.344
Revised Weighted Link S.E. 0.011

```
t-test value for exclusion         5.0
Number of items included            10
Revised Weighted Link Constant       0.357
Revised Weighted Link S.E.           0.010
```

Grade 4-5 Linking Results – Tested Lower Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g4wvlif.txt No. of Items - 73
Input File 2 - g5wvlif.txt No. of Items - 73

No.	Bank ID	g4wvlif.t Diff 1	g5wvlif.t Diff 2	SE 1	SE 2
1	NEW085008-08550	0.23	-0.84	0.03	0.01
2	NEW085012-08550	2.46	1.82	0.03	0.01
3	NEW085010-08550	0.75	-0.24	0.03	0.01
4	NEW085011-08550	-0.71	-1.91	0.03	0.01
5	E51135577	-0.17	-0.90	0.03	0.01
6	E5W03062	-0.06	-0.95	0.03	0.01
7	E5W03064	-0.82	-1.24	0.03	0.01
8	NEW085015-08551	2.63	2.25	0.04	0.01
9	NEW085021-08551	0.16	-1.00	0.03	0.01
10	NEW085017-08551	1.16	0.36	0.03	0.01
11	E500502W1	-0.69	-1.69	0.03	0.01
12	NEW085001-08552	1.39	0.72	0.03	0.01
13	NEW085000-08552	0.45	-0.50	0.03	0.01
14	E5S407135	1.09	0.36	0.03	0.01
15	E5S407134	0.63	0.27	0.03	0.01
16	E5S407132	1.30	0.66	0.03	0.01
17	E5S407130	2.05	1.41	0.03	0.01
18	E5S40734	0.85	-0.10	0.03	0.01
19	E5S40727	0.84	0.20	0.03	0.01
Mean		0.71	-0.07		

Unweighted Link Constant 0.783
Unweighted Link S.E. 0.007

Weighted Link Constant 0.788
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW085008-08550	0.23	-0.06	0.03	0.01	9.28	0.29
2	NEW085012-08550	2.46	2.60	0.03	0.01	-3.86	-0.14
3	NEW085010-08550	0.75	0.54	0.03	0.01	6.68	0.20
4	NEW085011-08550	-0.71	-1.12	0.03	0.01	11.42	0.42
5	E51135577	-0.17	-0.12	0.03	0.01	-1.40	-0.05
6	E5W03062	-0.06	-0.17	0.03	0.01	3.22	0.10
7	E5W03064	-0.82	-0.45	0.03	0.01	-10.04	-0.36
8	NEW085015-08551	2.63	3.04	0.04	0.01	-10.93	-0.41
9	NEW085021-08551	0.16	-0.22	0.03	0.01	12.29	0.38
10	NEW085017-08551	1.16	1.14	0.03	0.01	0.68	0.02
11	E500502W1	-0.69	-0.91	0.03	0.01	6.31	0.23
12	NEW085001-08552	1.39	1.50	0.03	0.01	-3.53	-0.11
13	NEW085000-08552	0.45	0.29	0.03	0.01	5.43	0.17
14	E5S407135	1.09	1.14	0.03	0.01	-1.80	-0.05
15	E5S407134	0.63	1.06	0.03	0.01	-14.20	-0.43
16	E5S407132	1.30	1.44	0.03	0.01	-4.54	-0.14
17	E5S407130	2.05	2.20	0.03	0.01	-4.46	-0.15
18	E5S40734	0.85	0.69	0.03	0.01	5.53	0.17
19	E5S40727	0.84	0.98	0.03	0.01	-4.70	-0.14

t-test value for exclusion 1.5
Number of items included 2
Revised Unweighted Link Constant 0.771
Revised Unweighted Link S.E. 0.022

t-test value for exclusion 2.0
Number of items included 3

Revised Unweighted Link Constant 0.757
Revised Unweighted Link S.E. 0.018

t-test value for exclusion 3.0
Number of items included 3
Revised Unweighted Link Constant 0.757
Revised Unweighted Link S.E. 0.018

t-test value for exclusion 4.0
Number of items included 6
Revised Unweighted Link Constant 0.746
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 5.0
Number of items included 9
Revised Unweighted Link Constant 0.711
Revised Unweighted Link S.E. 0.011

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW085008-08550	0.23	-0.05	0.03	0.01	9.15
2	NEW085012-08550	2.46	2.60	0.03	0.01	-3.98
3	NEW085010-08550	0.75	0.55	0.03	0.01	6.54
4	NEW085011-08550	-0.71	-1.12	0.03	0.01	11.31
5	E51135577	-0.17	-0.12	0.03	0.01	-1.54
6	E5W03062	-0.06	-0.16	0.03	0.01	3.08
7	E5W03064	-0.82	-0.45	0.03	0.01	-10.15
8	NEW085015-08551	2.63	3.04	0.04	0.01	-11.04
9	NEW085021-08551	0.16	-0.22	0.03	0.01	12.15
10	NEW085017-08551	1.16	1.14	0.03	0.01	0.54
11	E500502W1	-0.69	-0.91	0.03	0.01	6.19
12	NEW085001-08552	1.39	1.51	0.03	0.01	-3.67
13	NEW085000-08552	0.45	0.29	0.03	0.01	5.29
14	E5S407135	1.09	1.14	0.03	0.01	-1.94
15	E5S407134	0.63	1.06	0.03	0.01	-14.34
16	E5S407132	1.30	1.44	0.03	0.01	-4.68
17	E5S407130	2.05	2.20	0.03	0.01	-4.59
18	E5S40734	0.85	0.69	0.03	0.01	5.39
19	E5S40727	0.84	0.99	0.03	0.01	-4.84

t-test value for exclusion 1.5
Number of items included 1
Revised Weighted Link Constant 0.804
Revised Weighted Link S.E. 0.030

t-test value for exclusion 2.0
Number of items included 3
Revised Weighted Link Constant 0.758
Revised Weighted Link S.E. 0.018

t-test value for exclusion 3.0
Number of items included 3
Revised Weighted Link Constant 0.758
Revised Weighted Link S.E. 0.018

t-test value for exclusion 4.0
Number of items included 6
Revised Weighted Link Constant 0.749
Revised Weighted Link S.E. 0.013

t-test value for exclusion 5.0

Number of items included	9
Revised Weighted Link Constant	0.712
Revised Weighted Link S.E.	0.011

Grade 5-6 Linking Results – Tested Higher Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g5wvlif.txt No. of Items - 73
Input File 2 - g6wvlif.txt No. of Items - 73

No.	Bank ID	g5wvlif.t Diff 1	g6wvlif.t Diff 2	SE 1	SE 2
1	NEW085008-08550	-0.84	-0.44	0.01	0.02
2	NEW085012-08550	1.82	1.57	0.01	0.03
3	NEW085010-08550	-0.24	0.02	0.01	0.02
4	NEW085011-08550	-1.91	-1.15	0.01	0.03
5	NEW085015-08551	2.25	1.97	0.01	0.03
6	NEW085021-08551	-1.00	-0.59	0.01	0.03
7	NEW085017-08551	0.36	0.54	0.01	0.03
8	E500502W1	-1.69	-1.49	0.01	0.04
9	E51135577	-0.90	-1.03	0.01	0.03
10	E5S407135	0.36	0.32	0.01	0.03
11	E5S407134	0.27	0.51	0.01	0.03
12	E5S407132	0.66	0.87	0.01	0.03
13	E5S407130	1.41	1.49	0.01	0.03
14	E5W03064	-1.24	-1.14	0.01	0.04
15	E5W03062	-0.95	-0.55	0.01	0.03
16	NEW085001-08552	0.72	0.66	0.01	0.03
17	NEW085000-08552	-0.50	-0.05	0.01	0.03
18	E5S40734	-0.10	0.05	0.01	0.03
19	E5S40727	0.20	0.07	0.01	0.03
Mean		-0.07	0.09		

Unweighted Link Constant -0.155
Unweighted Link S.E. 0.007

Weighted Link Constant -0.161
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW085008-08550	-0.84	-0.60	0.01	0.02	-8.94	-0.24
2	NEW085012-08550	1.82	1.41	0.01	0.03	13.71	0.40
3	NEW085010-08550	-0.24	-0.14	0.01	0.02	-3.92	-0.10
4	NEW085011-08550	-1.91	-1.31	0.01	0.03	-19.42	-0.60
5	NEW085015-08551	2.25	1.81	0.01	0.03	12.80	0.44
6	NEW085021-08551	-1.00	-0.74	0.01	0.03	-7.72	-0.26
7	NEW085017-08551	0.36	0.38	0.01	0.03	-0.97	-0.03
8	E500502W1	-1.69	-1.64	0.01	0.04	-1.22	-0.05
9	E51135577	-0.90	-1.18	0.01	0.03	9.67	0.28
10	E5S407135	0.36	0.17	0.01	0.03	6.22	0.19
11	E5S407134	0.27	0.35	0.01	0.03	-2.67	-0.08
12	E5S407132	0.66	0.72	0.01	0.03	-2.08	-0.06
13	E5S407130	1.41	1.34	0.01	0.03	2.42	0.08
14	E5W03064	-1.24	-1.30	0.01	0.04	1.66	0.06
15	E5W03062	-0.95	-0.71	0.01	0.03	-8.80	-0.24
16	NEW085001-08552	0.72	0.50	0.01	0.03	7.22	0.22
17	NEW085000-08552	-0.50	-0.21	0.01	0.03	-9.10	-0.29
18	E5S40734	-0.10	-0.10	0.01	0.03	0.15	0.00
19	E5S40727	0.20	-0.09	0.01	0.03	9.36	0.29

t-test value for exclusion 1.5
Number of items included 3
Revised Unweighted Link Constant -0.181
Revised Unweighted Link S.E. 0.019

t-test value for exclusion 2.0
Number of items included 4

Revised Unweighted Link Constant -0.159
Revised Unweighted Link S.E. 0.017

t-test value for exclusion 3.0
Number of items included 7
Revised Unweighted Link Constant -0.167
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 8
Revised Unweighted Link Constant -0.178
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 5.0
Number of items included 8
Revised Unweighted Link Constant -0.178
Revised Unweighted Link S.E. 0.011

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW085008-08550	-0.84	-0.60	0.01	0.02	-8.73
2	NEW085012-08550	1.82	1.41	0.01	0.03	13.90
3	NEW085010-08550	-0.24	-0.14	0.01	0.02	-3.71
4	NEW085011-08550	-1.91	-1.31	0.01	0.03	-19.24
5	NEW085015-08551	2.25	1.81	0.01	0.03	12.96
6	NEW085021-08551	-1.00	-0.75	0.01	0.03	-7.55
7	NEW085017-08551	0.36	0.38	0.01	0.03	-0.78
8	E500502W1	-1.69	-1.65	0.01	0.04	-1.09
9	E51135577	-0.90	-1.19	0.01	0.03	9.86
10	E5S407135	0.36	0.16	0.01	0.03	6.41
11	E5S407134	0.27	0.35	0.01	0.03	-2.48
12	E5S407132	0.66	0.71	0.01	0.03	-1.89
13	E5S407130	1.41	1.33	0.01	0.03	2.60
14	E5W03064	-1.24	-1.30	0.01	0.04	1.80
15	E5W03062	-0.95	-0.71	0.01	0.03	-8.60
16	NEW085001-08552	0.72	0.50	0.01	0.03	7.41
17	NEW085000-08552	-0.50	-0.22	0.01	0.03	-8.92
18	E5S40734	-0.10	-0.11	0.01	0.03	0.34
19	E5S40727	0.20	-0.09	0.01	0.03	9.55

t-test value for exclusion 1.5
Number of items included 3
Revised Weighted Link Constant -0.176
Revised Weighted Link S.E. 0.019

t-test value for exclusion 2.0
Number of items included 5
Revised Weighted Link Constant -0.173
Revised Weighted Link S.E. 0.015

t-test value for exclusion 3.0
Number of items included 7
Revised Weighted Link Constant -0.169
Revised Weighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 8
Revised Weighted Link Constant -0.185
Revised Weighted Link S.E. 0.011

t-test value for exclusion 5.0

Number of items included	8
Revised Weighted Link Constant	-0.185
Revised Weighted Link S.E.	0.011

Grade 5-6 Linking Results – Tested Lower Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g5wvlif.txt No. of Items - 73
Input File 2 - g6wvlif.txt No. of Items - 73

No.	Bank ID	g5wvlif.t Diff 1	g6wvlif.t Diff 2	SE 1	SE 2
1	NEW086006-08650	0.31	0.27	0.03	0.01
2	NEW086000-08650	0.95	0.72	0.03	0.01
3	NEW086001-08650	0.67	0.11	0.03	0.01
4	E6W03129	0.33	-0.18	0.03	0.01
5	NEW086008-08651	1.37	1.12	0.03	0.01
6	NEW086015-08651	0.35	-0.03	0.03	0.01
7	NEW086013-08651	-0.06	-0.68	0.03	0.01
8	NEW086009-08651	0.13	-0.35	0.03	0.01
9	E600307W000	0.25	-0.18	0.03	0.01
10	NEW086020-08652	0.37	0.48	0.03	0.01
11	NEW086022-08652	1.49	1.25	0.03	0.01
12	NEW086019-08652	0.16	-0.13	0.03	0.01
13	NEW086024-08652	-1.01	-1.31	0.03	0.01
14	E600406W1	-0.37	-0.35	0.03	0.01
15	E61135995	-0.76	-1.03	0.03	0.01
16	E600405W02	1.81	1.67	0.03	0.01
17	E6W04191916	-1.48	-1.88	0.04	0.01
18	E600402W1	0.06	-0.28	0.03	0.01
19	E6W03132	-0.80	-0.97	0.03	0.01
20	E61135998	0.36	0.34	0.03	0.01
Mean		0.21	-0.07		

Unweighted Link Constant 0.276
Unweighted Link S.E. 0.007

Weighted Link Constant 0.276
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW086006-08650	0.31	0.55	0.03	0.01	-8.08	-0.24
2	NEW086000-08650	0.95	0.99	0.03	0.01	-1.44	-0.04
3	NEW086001-08650	0.67	0.38	0.03	0.01	9.60	0.29
4	E6W03129	0.33	0.10	0.03	0.01	7.66	0.23
5	NEW086008-08651	1.37	1.40	0.03	0.01	-0.70	-0.02
6	NEW086015-08651	0.35	0.25	0.03	0.01	3.36	0.10
7	NEW086013-08651	-0.06	-0.41	0.03	0.01	11.14	0.34
8	NEW086009-08651	0.13	-0.08	0.03	0.01	6.75	0.20
9	E600307W000	0.25	0.10	0.03	0.01	4.97	0.15
10	NEW086020-08652	0.37	0.75	0.03	0.01	-12.73	-0.38
11	NEW086022-08652	1.49	1.53	0.03	0.01	-1.05	-0.03
12	NEW086019-08652	0.16	0.15	0.03	0.01	0.32	0.01
13	NEW086024-08652	-1.01	-1.03	0.03	0.01	0.56	0.02
14	E600406W1	-0.37	-0.08	0.03	0.01	-9.16	-0.29
15	E61135995	-0.76	-0.75	0.03	0.01	-0.14	-0.00
16	E600405W02	1.81	1.95	0.03	0.01	-4.25	-0.14
17	E6W04191916	-1.48	-1.61	0.04	0.01	2.99	0.12
18	E600402W1	0.06	0.00	0.03	0.01	2.05	0.06
19	E6W03132	-0.80	-0.69	0.03	0.01	-3.24	-0.11
20	E61135998	0.36	0.62	0.03	0.01	-8.76	-0.26

t-test value for exclusion 1.5
Number of items included 6
Revised Unweighted Link Constant 0.264
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 2.0
Number of items included 6
Revised Unweighted Link Constant 0.264
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 8
Revised Unweighted Link Constant 0.290
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 10
Revised Unweighted Link Constant 0.286
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 12
Revised Unweighted Link Constant 0.285
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW086006-08650	0.31	0.55	0.03	0.01	-8.08
2	NEW086000-08650	0.95	0.99	0.03	0.01	-1.44
3	NEW086001-08650	0.67	0.38	0.03	0.01	9.61
4	E6W03129	0.33	0.10	0.03	0.01	7.66
5	NEW086008-08651	1.37	1.40	0.03	0.01	-0.70
6	NEW086015-08651	0.35	0.25	0.03	0.01	3.36
7	NEW086013-08651	-0.06	-0.41	0.03	0.01	11.15
8	NEW086009-08651	0.13	-0.08	0.03	0.01	6.76
9	E600307W000	0.25	0.10	0.03	0.01	4.98
10	NEW086020-08652	0.37	0.75	0.03	0.01	-12.72
11	NEW086022-08652	1.49	1.53	0.03	0.01	-1.05
12	NEW086019-08652	0.16	0.15	0.03	0.01	0.33
13	NEW086024-08652	-1.01	-1.03	0.03	0.01	0.56
14	E600406W1	-0.37	-0.08	0.03	0.01	-9.15
15	E61135995	-0.76	-0.75	0.03	0.01	-0.13
16	E600405W02	1.81	1.95	0.03	0.01	-4.25
17	E6W04191916	-1.48	-1.61	0.04	0.01	2.99
18	E600402W1	0.06	0.00	0.03	0.01	2.06
19	E6W03132	-0.80	-0.69	0.03	0.01	-3.23
20	E61135998	0.36	0.62	0.03	0.01	-8.75

t-test value for exclusion 1.5
Number of items included 6
Revised Weighted Link Constant 0.262
Revised Weighted Link S.E. 0.013

t-test value for exclusion 2.0
Number of items included 6
Revised Weighted Link Constant 0.262
Revised Weighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 8
Revised Weighted Link Constant 0.284
Revised Weighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 10
Revised Weighted Link Constant 0.284
Revised Weighted Link S.E. 0.010

t-test value for exclusion	5.0
Number of items included	12
Revised Weighted Link Constant	0.286
Revised Weighted Link S.E.	0.009

Grade 6-7 Linking Results – Tested Higher Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g6wvlif.txt No. of Items - 73
Input File 2 - g7wvlif.txt No. of Items - 73

No.	Bank ID	g6wvlif.t Diff 1	g7wvlif.t Diff 2	SE 1	SE 2
1	NEW086006-08650	0.27	0.16	0.01	0.02
2	NEW086000-08650	0.72	0.85	0.01	0.02
3	NEW086001-08650	0.11	0.24	0.01	0.02
4	NEW086008-08651	1.12	1.12	0.01	0.03
5	NEW086015-08651	-0.03	0.27	0.01	0.03
6	NEW086013-08651	-0.68	-0.38	0.01	0.03
7	NEW086009-08651	-0.35	-0.08	0.01	0.03
8	E61135995	-1.03	-0.87	0.01	0.03
9	E600406W1	-0.35	-0.27	0.01	0.03
10	E600405W02	1.67	1.50	0.01	0.03
11	NEW086020-08652	0.48	0.63	0.01	0.03
12	NEW086022-08652	1.25	1.13	0.01	0.03
13	NEW086019-08652	-0.13	0.24	0.01	0.03
14	NEW086024-08652	-1.31	-1.14	0.01	0.04
15	E6W03129	-0.18	0.04	0.01	0.02
16	E6W04191916	-1.88	-1.68	0.01	0.04
17	E600307W000	-0.18	-0.26	0.01	0.03
18	E600402W1	-0.28	-0.30	0.01	0.03
19	E61135998	0.34	0.40	0.01	0.03
20	E6W03132	-0.97	-1.08	0.01	0.04
Mean		-0.07	0.02		

Unweighted Link Constant -0.094
Unweighted Link S.E. 0.007

Weighted Link Constant -0.092
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW086006-08650	0.27	0.06	0.01	0.02	8.06	0.21
2	NEW086000-08650	0.72	0.76	0.01	0.02	-1.50	-0.04
3	NEW086001-08650	0.11	0.14	0.01	0.02	-1.49	-0.04
4	NEW086008-08651	1.12	1.02	0.01	0.03	3.27	0.10
5	NEW086015-08651	-0.03	0.18	0.01	0.03	-6.79	-0.21
6	NEW086013-08651	-0.68	-0.47	0.01	0.03	-6.31	-0.21
7	NEW086009-08651	-0.35	-0.18	0.01	0.03	-5.54	-0.18
8	E61135995	-1.03	-0.96	0.01	0.03	-1.76	-0.06
9	E600406W1	-0.35	-0.37	0.01	0.03	0.45	0.01
10	E600405W02	1.67	1.40	0.01	0.03	8.59	0.27
11	NEW086020-08652	0.48	0.54	0.01	0.03	-2.07	-0.06
12	NEW086022-08652	1.25	1.03	0.01	0.03	7.08	0.22
13	NEW086019-08652	-0.13	0.14	0.01	0.03	-8.71	-0.27
14	NEW086024-08652	-1.31	-1.24	0.01	0.04	-1.74	-0.07
15	E6W03129	-0.18	-0.06	0.01	0.02	-4.54	-0.12
16	E6W04191916	-1.88	-1.78	0.01	0.04	-2.30	-0.11
17	E600307W000	-0.18	-0.36	0.01	0.03	5.63	0.18
18	E600402W1	-0.28	-0.40	0.01	0.03	3.78	0.12
19	E61135998	0.34	0.30	0.01	0.03	1.37	0.04
20	E6W03132	-0.97	-1.17	0.01	0.04	5.31	0.20

t-test value for exclusion 1.5
Number of items included 3
Revised Unweighted Link Constant -0.089
Revised Unweighted Link S.E. 0.017

t-test value for exclusion 2.0
Number of items included 6
Revised Unweighted Link Constant -0.120
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 8
Revised Unweighted Link Constant -0.135
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 10
Revised Unweighted Link Constant -0.104
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 11
Revised Unweighted Link Constant -0.114
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW086006-08650	0.27	0.06	0.01	0.02	7.98
2	NEW086000-08650	0.72	0.76	0.01	0.02	-1.58
3	NEW086001-08650	0.11	0.15	0.01	0.02	-1.57
4	NEW086008-08651	1.12	1.02	0.01	0.03	3.20
5	NEW086015-08651	-0.03	0.18	0.01	0.03	-6.86
6	NEW086013-08651	-0.68	-0.47	0.01	0.03	-6.38
7	NEW086009-08651	-0.35	-0.17	0.01	0.03	-5.61
8	E61135995	-1.03	-0.96	0.01	0.03	-1.82
9	E600406W1	-0.35	-0.36	0.01	0.03	0.39
10	E600405W02	1.67	1.40	0.01	0.03	8.52
11	NEW086020-08652	0.48	0.54	0.01	0.03	-2.14
12	NEW086022-08652	1.25	1.04	0.01	0.03	7.01
13	NEW086019-08652	-0.13	0.14	0.01	0.03	-8.78
14	NEW086024-08652	-1.31	-1.24	0.01	0.04	-1.79
15	E6W03129	-0.18	-0.06	0.01	0.02	-4.62
16	E6W04191916	-1.88	-1.77	0.01	0.04	-2.35
17	E600307W000	-0.18	-0.36	0.01	0.03	5.56
18	E600402W1	-0.28	-0.40	0.01	0.03	3.72
19	E61135998	0.34	0.30	0.01	0.03	1.30
20	E6W03132	-0.97	-1.17	0.01	0.04	5.25

t-test value for exclusion 1.5
Number of items included 2
Revised Weighted Link Constant -0.065
Revised Weighted Link S.E. 0.022

t-test value for exclusion 2.0
Number of items included 6
Revised Weighted Link Constant -0.118
Revised Weighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 8
Revised Weighted Link Constant -0.128
Revised Weighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 10
Revised Weighted Link Constant -0.099
Revised Weighted Link S.E. 0.010

```
t-test value for exclusion         5.0
Number of items included            11
Revised Weighted Link Constant      -0.113
Revised Weighted Link S.E.           0.009
```

Grade 6-7 Linking Results – Tested Lower Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g6wvlif.txt No. of Items - 73
Input File 2 - g7wvlif.txt No. of Items - 73

No.	Bank ID	g6wvlif.t Diff 1	g7wvlif.t Diff 2	SE 1	SE 2
1	NEW087022-08753	0.52	-0.03	0.03	0.01
2	NEW087017-08753	-0.17	-0.78	0.03	0.01
3	E700404W02	-0.23	-0.84	0.03	0.01
4	E7W03100	0.25	-0.05	0.03	0.01
5	E7W03103	-0.03	-0.05	0.03	0.01
6	NEW087011-08751	1.46	0.89	0.03	0.01
7	NEW087012-08751	-0.16	-0.42	0.03	0.01
8	NEW087015-08751	0.74	0.40	0.03	0.01
9	NEW087014-08751	1.43	1.04	0.03	0.01
10	NEW087013-08751	0.03	-0.26	0.03	0.01
11	E7W03098	0.34	0.16	0.03	0.01
12	NEW087004-08758	0.25	-0.15	0.03	0.01
13	NEW087003-08758	-0.27	-0.71	0.03	0.01
14	NEW087006-08758	-0.29	-0.79	0.03	0.01
15	NEW087005-08758	0.37	-0.28	0.03	0.01
16	E7S407103	0.07	-0.29	0.03	0.01
17	E7S407104	1.07	0.92	0.03	0.01
18	E7S40773	0.88	0.66	0.03	0.01
19	E7S40775	0.96	0.58	0.03	0.01
20	E7S40782	0.75	0.65	0.03	0.01
Mean		0.40	0.03		

Unweighted Link Constant 0.366
Unweighted Link S.E. 0.007

Weighted Link Constant 0.361
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW087022-08753	0.52	0.34	0.03	0.01	6.07	0.18
2	NEW087017-08753	-0.17	-0.42	0.03	0.01	7.69	0.25
3	E700404W02	-0.23	-0.48	0.03	0.01	7.69	0.25
4	E7W03100	0.25	0.32	0.03	0.01	-2.12	-0.06
5	E7W03103	-0.03	0.32	0.03	0.01	-11.34	-0.35
6	NEW087011-08751	1.46	1.26	0.03	0.01	6.35	0.20
7	NEW087012-08751	-0.16	-0.05	0.03	0.01	-3.41	-0.11
8	NEW087015-08751	0.74	0.77	0.03	0.01	-1.07	-0.03
9	NEW087014-08751	1.43	1.41	0.03	0.01	0.86	0.03
10	NEW087013-08751	0.03	0.11	0.03	0.01	-2.57	-0.08
11	E7W03098	0.34	0.52	0.03	0.01	-6.07	-0.18
12	NEW087004-08758	0.25	0.21	0.03	0.01	1.32	0.04
13	NEW087003-08758	-0.27	-0.35	0.03	0.01	2.36	0.08
14	NEW087006-08758	-0.29	-0.42	0.03	0.01	4.21	0.14
15	NEW087005-08758	0.37	0.09	0.03	0.01	9.53	0.29
16	E7S407103	0.07	0.08	0.03	0.01	-0.31	-0.01
17	E7S407104	1.07	1.29	0.03	0.01	-7.22	-0.22
18	E7S40773	0.88	1.03	0.03	0.01	-4.95	-0.15
19	E7S40775	0.96	0.95	0.03	0.01	0.46	0.01
20	E7S40782	0.75	1.01	0.03	0.01	-8.83	-0.26

t-test value for exclusion 1.5
Number of items included 5
Revised Unweighted Link Constant 0.373
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 2.0
Number of items included 5
Revised Unweighted Link Constant 0.373
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 3.0
Number of items included 8
Revised Unweighted Link Constant 0.362
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 9
Revised Unweighted Link Constant 0.350
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 11
Revised Unweighted Link Constant 0.352
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW087022-08753	0.52	0.33	0.03	0.01	6.20
2	NEW087017-08753	-0.17	-0.42	0.03	0.01	7.82
3	E700404W02	-0.23	-0.48	0.03	0.01	7.82
4	E7W03100	0.25	0.31	0.03	0.01	-1.99
5	E7W03103	-0.03	0.32	0.03	0.01	-11.21
6	NEW087011-08751	1.46	1.25	0.03	0.01	6.48
7	NEW087012-08751	-0.16	-0.06	0.03	0.01	-3.28
8	NEW087015-08751	0.74	0.76	0.03	0.01	-0.93
9	NEW087014-08751	1.43	1.40	0.03	0.01	0.99
10	NEW087013-08751	0.03	0.10	0.03	0.01	-2.44
11	E7W03098	0.34	0.52	0.03	0.01	-5.93
12	NEW087004-08758	0.25	0.21	0.03	0.01	1.45
13	NEW087003-08758	-0.27	-0.35	0.03	0.01	2.49
14	NEW087006-08758	-0.29	-0.43	0.03	0.01	4.34
15	NEW087005-08758	0.37	0.08	0.03	0.01	9.66
16	E7S407103	0.07	0.07	0.03	0.01	-0.18
17	E7S407104	1.07	1.28	0.03	0.01	-7.08
18	E7S40773	0.88	1.02	0.03	0.01	-4.81
19	E7S40775	0.96	0.95	0.03	0.01	0.60
20	E7S40782	0.75	1.01	0.03	0.01	-8.69

t-test value for exclusion 1.5
Number of items included 5
Revised Weighted Link Constant 0.373
Revised Weighted Link S.E. 0.014

t-test value for exclusion 2.0
Number of items included 6
Revised Weighted Link Constant 0.361
Revised Weighted Link S.E. 0.012

t-test value for exclusion 3.0
Number of items included 8
Revised Weighted Link Constant 0.361
Revised Weighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 9
Revised Weighted Link Constant 0.350
Revised Weighted Link S.E. 0.010

```
t-test value for exclusion         5.0
Number of items included            11
Revised Weighted Link Constant       0.350
Revised Weighted Link S.E.           0.009
```

Grade 7-8 Linking Results – Tested Higher Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g7wvlif.txt No. of Items - 73
Input File 2 - g8wvlif.txt No. of Items - 49

No.	Bank ID	g7wvlif.t Diff 1	g8wvlif.t Diff 2	SE 1	SE 2
1	NEW087022-08753	-0.03	0.31	0.01	0.02
2	NEW087017-08753	-0.78	-0.46	0.01	0.02
3	E7W03098	0.16	0.20	0.01	0.02
4	E7W03103	-0.05	-0.06	0.01	0.02
5	NEW087004-08758	-0.15	0.26	0.01	0.02
6	NEW087003-08758	-0.71	-0.56	0.01	0.02
7	NEW087006-08758	-0.79	-0.40	0.01	0.02
8	NEW087005-08758	-0.28	0.10	0.01	0.02
9	E700404W02	-0.84	-0.55	0.01	0.02
10	E7S407103	-0.29	-0.32	0.01	0.02
11	E7S407104	0.92	0.95	0.01	0.02
12	NEW087011-08751	0.89	0.90	0.01	0.02
13	NEW087012-08751	-0.42	-0.32	0.01	0.02
14	NEW087015-08751	0.40	0.62	0.01	0.02
15	NEW087014-08751	1.04	1.32	0.01	0.02
16	NEW087013-08751	-0.26	-0.07	0.01	0.02
17	E7W03100	-0.05	0.02	0.01	0.02
18	E7S40773	0.66	0.45	0.01	0.02
19	E7S40775	0.58	0.58	0.01	0.02
20	E7S40782	0.65	0.62	0.01	0.02
Mean		0.03	0.18		

Unweighted Link Constant -0.147
Unweighted Link S.E. 0.005

Weighted Link Constant -0.144
Weighted Link S.E. 0.005

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW087022-08753	-0.03	0.16	0.01	0.02	-8.98	-0.19
2	NEW087017-08753	-0.78	-0.61	0.01	0.02	-7.48	-0.17
3	E7W03098	0.16	0.06	0.01	0.02	4.34	0.10
4	E7W03103	-0.05	-0.21	0.01	0.02	6.85	0.16
5	NEW087004-08758	-0.15	0.12	0.01	0.02	-11.82	-0.27
6	NEW087003-08758	-0.71	-0.71	0.01	0.02	-0.07	-0.00
7	NEW087006-08758	-0.79	-0.55	0.01	0.02	-9.63	-0.24
8	NEW087005-08758	-0.28	-0.05	0.01	0.02	-10.15	-0.23
9	E700404W02	-0.84	-0.69	0.01	0.02	-6.52	-0.15
10	E7S407103	-0.29	-0.47	0.01	0.02	7.52	0.18
11	E7S407104	0.92	0.80	0.01	0.02	5.50	0.12
12	NEW087011-08751	0.89	0.75	0.01	0.02	6.28	0.14
13	NEW087012-08751	-0.42	-0.47	0.01	0.02	1.91	0.05
14	NEW087015-08751	0.40	0.48	0.01	0.02	-3.39	-0.08
15	NEW087014-08751	1.04	1.17	0.01	0.02	-5.66	-0.13
16	NEW087013-08751	-0.26	-0.22	0.01	0.02	-1.61	-0.04
17	E7W03100	-0.05	-0.12	0.01	0.02	3.59	0.08
18	E7S40773	0.66	0.31	0.01	0.02	15.92	0.35
19	E7S40775	0.58	0.43	0.01	0.02	6.96	0.15
20	E7S40782	0.65	0.48	0.01	0.02	7.64	0.17

t-test value for exclusion 1.5
Number of items included 1
Revised Unweighted Link Constant -0.148
Revised Unweighted Link S.E. 0.026

t-test value for exclusion 2.0
Number of items included 3
Revised Unweighted Link Constant -0.144
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 3.0
Number of items included 3
Revised Unweighted Link Constant -0.144
Revised Unweighted Link S.E. 0.014

t-test value for exclusion 4.0
Number of items included 5
Revised Unweighted Link Constant -0.145
Revised Unweighted Link S.E. 0.010

t-test value for exclusion 5.0
Number of items included 6
Revised Unweighted Link Constant -0.129
Revised Unweighted Link S.E. 0.009

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW087022-08753	-0.03	0.16	0.01	0.02	-9.10
2	NEW087017-08753	-0.78	-0.61	0.01	0.02	-7.60
3	E7W03098	0.16	0.06	0.01	0.02	4.22
4	E7W03103	-0.05	-0.20	0.01	0.02	6.73
5	NEW087004-08758	-0.15	0.12	0.01	0.02	-11.94
6	NEW087003-08758	-0.71	-0.71	0.01	0.02	-0.17
7	NEW087006-08758	-0.79	-0.55	0.01	0.02	-9.73
8	NEW087005-08758	-0.28	-0.04	0.01	0.02	-10.27
9	E700404W02	-0.84	-0.69	0.01	0.02	-6.63
10	E7S407103	-0.29	-0.47	0.01	0.02	7.41
11	E7S407104	0.92	0.80	0.01	0.02	5.38
12	NEW087011-08751	0.89	0.76	0.01	0.02	6.16
13	NEW087012-08751	-0.42	-0.46	0.01	0.02	1.80
14	NEW087015-08751	0.40	0.48	0.01	0.02	-3.51
15	NEW087014-08751	1.04	1.17	0.01	0.02	-5.78
16	NEW087013-08751	-0.26	-0.22	0.01	0.02	-1.73
17	E7W03100	-0.05	-0.12	0.01	0.02	3.47
18	E7S40773	0.66	0.31	0.01	0.02	15.80
19	E7S40775	0.58	0.43	0.01	0.02	6.84
20	E7S40782	0.65	0.48	0.01	0.02	7.52

t-test value for exclusion 1.5
Number of items included 1
Revised Weighted Link Constant -0.148
Revised Weighted Link S.E. 0.026

t-test value for exclusion 2.0
Number of items included 3
Revised Weighted Link Constant -0.145
Revised Weighted Link S.E. 0.014

t-test value for exclusion 3.0
Number of items included 3
Revised Weighted Link Constant -0.145
Revised Weighted Link S.E. 0.014

t-test value for exclusion 4.0
Number of items included 5
Revised Weighted Link Constant -0.144
Revised Weighted Link S.E. 0.010

```
t-test value for exclusion         5.0
Number of items included             6
Revised Weighted Link Constant      -0.127
Revised Weighted Link S.E.           0.009
```

Grade 7-8 Linking Results – Tested Lower Items Only

Unweighted and Weighted Link Constants for Test Equating

Input File 1 - g7wvlif.txt No. of Items - 73
Input File 2 - g8wvlif.txt No. of Items - 49

No.	Bank ID	g7wvlif.t Diff 1	g8wvlif.t Diff 2	SE 1	SE 2
1	NEW088019-08853	1.71	1.43	0.03	0.01
2	NEW088017-08853	0.08	-0.32	0.03	0.01
3	E8W03137	0.70	0.19	0.03	0.01
4	E8S407127	0.55	0.16	0.03	0.01
5	NEW088013-08850	0.65	0.05	0.03	0.01
6	NEW088011-08850	-0.89	-1.27	0.03	0.01
7	NEW088008-08850	2.29	1.65	0.03	0.01
8	NEW088010-08850	0.92	0.80	0.03	0.01
9	NEW088006-08851	-0.15	-0.53	0.03	0.01
10	NEW088001-08851	-1.34	-1.90	0.04	0.02
11	NEW088003-08851	0.65	0.33	0.03	0.01
12	NEW088000-08851	0.72	0.36	0.03	0.01
13	NEW088007-08851	1.20	0.66	0.03	0.01
14	E8S407126	1.72	1.03	0.03	0.01
15	E8S40778	-0.33	-0.55	0.03	0.01
16	E8S40781	1.56	1.63	0.03	0.01
17	E81135586	-1.23	-1.75	0.04	0.02
18	E81135589	-0.99	-1.44	0.04	0.01
19	E81135585	0.49	0.36	0.03	0.01
Mean		0.44	0.05		

Unweighted Link Constant 0.390
Unweighted Link S.E. 0.007

Weighted Link Constant 0.379
Weighted Link S.E. 0.007

Linked Item Difficulties - Unweighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test	d-diff
1	NEW088019-08853	1.71	1.82	0.03	0.01	-3.31	-0.11
2	NEW088017-08853	0.08	0.07	0.03	0.01	0.21	0.01
3	E8W03137	0.70	0.58	0.03	0.01	4.03	0.12
4	E8S407127	0.55	0.55	0.03	0.01	-0.01	-0.00
5	NEW088013-08850	0.65	0.44	0.03	0.01	7.05	0.21
6	NEW088011-08850	-0.89	-0.88	0.03	0.01	-0.23	-0.01
7	NEW088008-08850	2.29	2.04	0.03	0.01	7.30	0.26
8	NEW088010-08850	0.92	1.19	0.03	0.01	-8.99	-0.27
9	NEW088006-08851	-0.15	-0.14	0.03	0.01	-0.55	-0.02
10	NEW088001-08851	-1.34	-1.51	0.04	0.02	3.88	0.16
11	NEW088003-08851	0.65	0.72	0.03	0.01	-2.48	-0.07
12	NEW088000-08851	0.72	0.75	0.03	0.01	-1.04	-0.03
13	NEW088007-08851	1.20	1.05	0.03	0.01	4.98	0.15
14	E8S407126	1.72	1.42	0.03	0.01	9.28	0.30
15	E8S40778	-0.33	-0.16	0.03	0.01	-5.11	-0.17
16	E8S40781	1.56	2.02	0.03	0.01	-14.66	-0.46
17	E81135586	-1.23	-1.36	0.04	0.02	3.00	0.12
18	E81135589	-0.99	-1.05	0.04	0.01	1.49	0.06
19	E81135585	0.49	0.75	0.03	0.01	-8.38	-0.25

t-test value for exclusion 1.5
Number of items included 6
Revised Unweighted Link Constant 0.391
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 2.0
Number of items included 6

Revised Unweighted Link Constant 0.391
Revised Unweighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 7
Revised Unweighted Link Constant 0.380
Revised Unweighted Link S.E. 0.012

t-test value for exclusion 4.0
Number of items included 10
Revised Unweighted Link Constant 0.401
Revised Unweighted Link S.E. 0.011

t-test value for exclusion 5.0
Number of items included 12
Revised Unweighted Link Constant 0.422
Revised Unweighted Link S.E. 0.010

Linked Item Difficulties - Weighted Link Constant

No.	Bank ID	Diff 1	Diff 2	SE 1	SE 2	t-test
1	NEW088019-08853	1.71	1.81	0.03	0.01	-2.96
2	NEW088017-08853	0.08	0.06	0.03	0.01	0.57
3	E8W03137	0.70	0.57	0.03	0.01	4.40
4	E8S407127	0.55	0.53	0.03	0.01	0.36
5	NEW088013-08850	0.65	0.43	0.03	0.01	7.43
6	NEW088011-08850	-0.89	-0.89	0.03	0.01	0.07
7	NEW088008-08850	2.29	2.03	0.03	0.01	7.63
8	NEW088010-08850	0.92	1.18	0.03	0.01	-8.61
9	NEW088006-08851	-0.15	-0.15	0.03	0.01	-0.20
10	NEW088001-08851	-1.34	-1.52	0.04	0.02	4.15
11	NEW088003-08851	0.65	0.71	0.03	0.01	-2.10
12	NEW088000-08851	0.72	0.74	0.03	0.01	-0.67
13	NEW088007-08851	1.20	1.04	0.03	0.01	5.35
14	E8S407126	1.72	1.41	0.03	0.01	9.63
15	E8S40778	-0.33	-0.17	0.03	0.01	-4.77
16	E8S40781	1.56	2.01	0.03	0.01	-14.30
17	E81135586	-1.23	-1.37	0.04	0.02	3.28
18	E81135589	-0.99	-1.06	0.04	0.01	1.79
19	E81135585	0.49	0.73	0.03	0.01	-8.01

t-test value for exclusion 1.5
Number of items included 5
Revised Weighted Link Constant 0.379
Revised Weighted Link S.E. 0.014

t-test value for exclusion 2.0
Number of items included 6
Revised Weighted Link Constant 0.388
Revised Weighted Link S.E. 0.013

t-test value for exclusion 3.0
Number of items included 8
Revised Weighted Link Constant 0.364
Revised Weighted Link S.E. 0.011

t-test value for exclusion 4.0
Number of items included 9
Revised Weighted Link Constant 0.375
Revised Weighted Link S.E. 0.011

t-test value for exclusion 5.0

Number of items included	12
Revised Weighted Link Constant	0.385
Revised Weighted Link S.E.	0.010

Appendix B-2

South Carolina Palmetto Assessment of State Standards
Vertical Scaling Study

Draft

July 2009

Purpose

This document outlines the processes by which Pearson devised vertical scales for the Palmetto Assessment of State Standards (PASS) tests in Reading and Research (ELA), Mathematics, Science, and Social Studies.

Design

The data collection design for this vertical scaling study was a *common item design* (Young, 2006; Kolen & Brennan, 2004). Items used for the study were appended to the PASS base tests forms. In each instance, sets of items appended to the base forms consisted of six unique items from the grade above and/or the grade lower. For grades 3 and 8, three forms were created while six forms were created for grades 4 through 7. Thus there were a total of 36 items used for vertical scaling in grades 4 through 7, and 18 items at grades 3 and 8, per subject.

The vertical scale was created such that all grades were mapped onto the fifth grade scale. While there are other methods of establishing a vertical scale, it was determined that beginning in a middle grade was best since the South Carolina Department of Education (SCDE) required that the vertical scale linking items be appended both one grade up and one grade down.

Analysis

Calibration/Stability

The vertical linking items were calibrated by using the operational (base form) items as anchor items. Two independent calibrations were conducted and compared for accuracy. It should be noted that one mathematics item in grade 5 and one in grade 6 were scored as *all correct*, but these items were not used as part of the anchored calibration of the vertical linking items. After calibration, the mean/mean method (Kolen & Brennan, 2004) was used to obtain level linking constants throughout the vertical scaling process. The differences between the common items across two adjacent grade levels were examined via a directional Robust Z analysis.

Similar to the Robust Z analysis for the PASS operational scaling, the criteria of 1) the correlation of common-item difficulties greater than 0.95 and 2) the ratio of standard deviations of common-item difficulties across adjacent grades between 0.9 and 1.1 were used to determine if items should be excluded from the calculation of the level linking constant. If either of these criteria were violated then any vertical linking item that 1) performed better at the lower grade than at the higher grade and then 2) had a Robust Z statistic greater than 1.645 was removed from the analysis. Table 1 shows the number of vertical linking items removed from each analysis.

In all cases there was at least one item that performed better at the lower grade than at the higher grade, but the Robust Z statistic was below 1.645 and, therefore, the item was not excluded. The number of items for which this occurred for each level is also shown in Table 1. For these items, the range of Rasch value differences between the adjacent grades is provided.

Table 1. Vertical Linking Items

Subject	Level	Number of Items Removed *(Performing better at the lower grade and Robust Z > 1.645)*	Number of Items Kept *(Performing better at the lower grade and Robust Z < 1.645)*	Range of Rasch Differences for Items Kept *(Performing better at the lower grade and Robust Z < 1.645)*
ELA	3-4	1	1	(0.1403)*
	4-5	1	10	(0.0955, 0.5053)*
	5-6	1	4	(0.0314, 0.2326)
	6-7	4	8	(0.08, 0.3619)
	7-8	1	13	(0.0116, 0.6421)
Mathematics	3-4	0	15	(0.3959, 1.2506)
	4-5	3	5	(0.0328, 0.1496)*
	5-6	0	7	(0.0427, 0.5674)
	6-7	1	14	(0.0331, 0.5524)
	7-8	0	6	(0.0224, 0.145)
Science	3-4	0	15	(0.0776, 0.8842)*
	4-5	1	8	(0.0613, 0.5186)*
	5-6	0	18	(0.0134, 0.6687)
	6-7	1	16	(0.0949, 0.9912)
	7-8	1	8	(0.0369, 0.3741)
Social Studies	3-4	1	5	(0.0828, 0.4278)*
	4-5	0	10	(0.0145, 0.7856)*
	5-6	0	18	(0.0136, 1.3458)
	6-7	0	5	(0.1085, 0.7026)
	7-8	1	26	(0.3959, 1.2506)

* *Absolute value.*

Table 2 shows the level linking constants derived after the vertical linking stability analysis.

Table 2. Vertical (Level) Linking Constants

Subject	Level	Linking Constant
ELA	3-4	-0.7264
	4-5	-0.2905
	5-6	0.4348
	6-7	0.4560
	7-8	0.1643
Mathematics	3-4	-0.2119
	4-5	-0.6136
	5-6	0.4083
	6-7	0.2212
	7-8	0.4216
Science	3-4	-0.1798
	4-5	-0.3902
	5-6	0.1316
	6-7	0.2297
	7-8	0.4600
Social Studies	3-4	-0.8403
	4-5	-0.8005
	5-6	0.0612
	6-7	0.7290
	7-8	-0.3651

Vertical Scaling

Since grade 5 was used as the base scale, the level linking constants were used cumulatively in order to put each grade onto the fifth grade scale. For example, in order to put grade 3 onto the grade 5 scale, the level linking constant for grade levels 3-4 and for grade levels 4-5 were added to the grade 3 operational items' difficulty parameters and theta estimates. On the other end, to put grade 8 onto the grade 5 scale, the level linking constants for grade levels 5-6, grade levels 6-7, and grade levels 7-8 were added to the grade 8 operational items' difficulty parameters and theta estimates. The remaining grades were mapped onto the grade 5 scale in similar fashion. Table 3 shows the cumulative vertical linking constants as used to map each grade onto the grade 5 scale. The linking constants from Table 2 were rounded to the fourth decimal place prior to computing the cumulative constants.

Table 3. Cumulative Vertical (Level) Linking Constants

Subject	Grade	Cumulative Constant
ELA	3	-1.0169
	4	-0.2905
	5	0.0000
	6	0.4348
	7	0.8908
	8	1.0551
Mathematics	3	-0.8255
	4	-0.6136
	5	0.0000
	6	0.4083
	7	0.6295
	8	1.0511
Science	3	-0.5700
	4	-0.3902
	5	0.0000
	6	0.1316
	7	0.3613
	8	0.8213
Social Studies	3	-1.6408
	4	-0.8005
	5	0.0000
	6	0.0612
	7	0.7902
	8	0.4251

The average of the theta estimates after adding the cumulative vertical linking constants are shown in Table 4. It should be pointed out that a reversal in mean theta occurred in ELA between grades 3 and 4.

Table 4. Mean Vertical Linking Theta Estimates

Subject	*Grade 3*	*Grade 4*	*Grade 5*	*Grade 6*	*Grade7*	*Grade8*
ELA	-0.9613	-0.9783	-0.5658	-0.2294	0.0733	0.3797
Mathematics	-1.3083	-0.6185	-0.0557	0.2125	0.8142	1.3081
Science	-1.0203	-0.7650	-0.0963	-0.0126	0.2778	0.6492
Social Studies	-1.1362	-0.5780	-0.1589	0.3100	0.5304	0.8510

Raw Score to Scale Score Transformation

Two approaches for deriving a transformation of the vertically linked theta estimates to reportable scale scores were used. One approach followed the procedure outlined by Kolen and Brennan (2004) to derive a unique slope and intercept combination for each PASS subject area. The other approach used a fixed slope of 15 and intercept of 300 for all PASS subjects. Each approach and the corresponding results are described in this section.

In both cases, the scale scores are computed as:

$$Scale\ score = (vl\_theta * slope) + intercept,$$

where *vl_theta* is the vertically linked theta estimate.

Method #1: Kolen & Brennan (2004)

Following this example, the desired mean scale score for grade 3 is 200 while that of grade 8 is 240, for all PASS subjects. It should be noted Kolen and Brennan utilized 250 as the desired mean scale score for grade 8, but their example was based on data calibrated and scaled according to the three parameter logistic (3PL) IRT model. For PASS, the data is calibrated and scaled according to the Rasch model which can lead to extreme theta estimates (i.e., theta estimates outside of the traditional -4 to +4 ability range). Therefore, using 250 as the scale score mean for grade 8 in this vertical linking study proved to be problematic due to the extreme low thetas that resulted in some grades, thus leading to some negative scale scores. Despite the attempt to prevent the negative scale scores, however, grade 5 and grade 6 Mathematics had theta estimates of extreme negative values (-10.0643 and -9.6929) for the raw score point of zero, leading to negative scale scores for that score point. In both cases, though, there were no students that earned a raw score point of zero, but it would be recommended that the scales are truncated at least at the lower end. As was mentioned earlier, one mathematics item was scored all correct in each of those two grades, but those items were not used as part of the anchored calibration of the vertical linking items.

The vertically linked theta estimates of grades 3 and 8 corresponding to a cumulative percent of 75% are used in the equations that determine the slope and intercept for each subject. The slope is computed as

$$\frac{sc(y_2) - sc(y_1)}{y_2 - y_1},$$

where $sc(y_2)$ is the desired scale score mean for grade 8, $sc(y_1)$ is the desired scale score mean for grade 3, y_2 is the vertically linked theta estimate for grade 8, and y_1 is the vertically linked theta estimate for grade 3. The intercept is computed as

$$sc(y_1) - \left[\frac{sc(y_2) - sc(y_1)}{y_2 - y_1}\right](y_1),$$

using the same parameter definitions as used for computing the slope. Table 5 shows the slopes and intercepts for all four subjects using this approach.

Table 5. Slope and Intercept Values for Scale Transformation

Subject	*Slope*	*Intercept*
ELA	25.7898	194.8085
Mathematics	21.7143	196.6603
Science	26.5041	195.8998
Social Studies	26.0926	200.2479

Tables 6 through 9 show the scale scores for each subject for grades 3 through 8.

Table 6. Scale Scores for ELA

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	33	35	42	51	59	62
1	66	67	74	83	90	93
2	85	86	94	103	109	112
3	97	98	106	114	121	124
4	107	107	115	123	130	132
5	114	114	122	130	136	139
6	120	121	128	136	142	144
7	126	126	134	141	147	149
8	131	131	139	146	152	154
9	136	136	143	151	156	158
10	141	140	148	155	160	162
11	145	145	152	159	163	165
12	149	149	156	162	167	169
13	153	152	159	166	170	172
14	156	156	163	169	173	175
15	160	160	167	173	176	178
16	164	163	170	176	179	181
17	167	167	173	179	182	183
18	171	170	177	182	185	186
19	174	174	180	186	187	189
20	178	177	184	189	190	191
21	181	181	187	192	193	194
22	185	184	190	195	195	196
23	188	188	194	198	198	199
24	192	191	197	202	201	201
25	196	195	201	205	203	204
26	200	199	205	208	206	206
27	204	203	209	212	209	209
28	209	208	213	215	212	212
29	214	213	217	219	215	214
30	219	218	222	223	217	217
31	225	224	227	227	220	219
32	233	231	232	232	224	222
33	241	240	238	236	227	225
34	253	252	246	242	230	228
35	273	271	255	248	234	231
36	305	303	267	255	238	234
37			286	264	242	237
38			319	275	246	240
39				295	251	243
40				327	257	247
41					264	251
42					272	255
43					284	260
44					302	265
45					334	271
46						279
47						287
48						299
49						319
50						351
N	54,717	53,103	52,336	51,692	51,465	51,775
Mean	183.57	198.60	204.38	212.21	220.58	224.29
SD	28.45	33.19	27.07	27.64	27.92	25.92

Table 7. Scale Scores for Mathematics

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	49	62	-22	-14	94	104
1	76	88	50	56	120	131
2	92	104	105	110	136	146
3	102	114	121	126	145	156
4	109	121	131	136	152	163
5	114	126	138	142	157	168
6	119	131	143	148	162	172
7	123	135	148	153	166	176
8	127	138	152	157	169	180
9	130	142	156	160	173	183
10	134	145	159	163	175	186
11	136	148	162	166	178	188
12	139	150	165	169	181	191
13	142	153	168	172	183	193
14	144	155	170	174	185	195
15	147	157	173	176	187	197
16	149	160	175	179	189	199
17	151	162	178	181	191	201
18	154	164	180	183	193	203
19	156	166	182	185	195	205
20	158	168	184	187	197	207
21	160	170	186	188	199	209
22	162	172	188	190	201	210
23	164	174	190	192	202	212
24	166	176	192	194	204	213
25	168	177	194	195	206	215
26	170	179	195	197	207	217
27	172	181	197	199	209	218
28	174	183	199	200	210	220
29	176	185	201	202	212	221
30	179	187	203	204	214	223
31	181	189	205	205	215	224
32	183	190	207	207	217	226
33	185	192	208	209	218	227
34	187	194	210	210	220	229
35	190	196	212	212	222	230
36	192	198	214	214	223	232
37	195	200	216	215	225	234
38	197	202	218	217	227	235
39	200	204	220	219	228	237
40	203	207	222	221	230	238
41	206	209	225	222	232	240
42	210	211	227	224	234	242
43	213	214	229	226	235	243
44	217	216	232	228	237	245
45	222	219	234	230	239	247
46	228	222	237	232	241	249
47	235	225	240	234	243	251
48	245	228	244	237	246	253
49	261	232	247	239	248	255
50	287	236	251	241	251	257
51		241	256	244	253	259
52		247	261	247	256	262
53		254	268	250	259	264
54		263	278	254	263	267
55		279	294	258	267	270
56		306	320	262	271	274
57				268	277	278
58				274	283	282
59				284	293	287
60				299	308	294
61				326	335	304
62						319
63						346
N	54,776	53,161	52,318	51,671	51,523	51,837
Mean	184.75	196.74	208.52	215.90	220.94	226.84
SD	23.80	24.05	23.08	23.81	22.02	23.07

Table 8. Scale Scores for Science

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	25	35	50	50	59	67
1	58	67	82	82	92	100
2	78	87	102	102	111	119
3	90	99	113	113	122	130
4	99	107	122	122	131	138
5	106	114	129	129	137	145
6	112	120	135	134	143	151
7	118	125	140	139	148	155
8	122	130	144	144	152	160
9	127	134	148	148	156	163
10	131	138	152	151	160	167
11	135	141	155	155	163	170
12	138	145	159	158	166	173
13	142	148	162	161	169	176
14	145	151	165	164	172	179
15	148	154	168	167	175	181
16	151	157	171	169	177	184
17	154	160	173	172	180	186
18	157	163	176	174	182	189
19	160	166	179	177	185	191
20	163	168	181	179	187	193
21	166	171	184	182	189	195
22	168	174	186	184	192	197
23	171	177	189	186	194	199
24	174	179	191	188	196	201
25	176	182	193	190	198	203
26	179	185	196	193	200	205
27	182	188	198	195	202	207
28	185	191	201	197	204	209
29	188	194	203	199	207	211
30	191	197	206	201	209	213
31	194	200	208	203	211	215
32	197	203	211	206	213	217
33	200	206	213	208	215	219
34	203	210	216	210	217	221
35	207	213	219	212	220	223
36	211	217	222	215	222	225
37	215	222	225	217	224	227
38	220	226	228	220	227	229
39	225	232	231	222	229	231
40	231	238	235	225	232	233
41	237	245	238	227	235	235
42	246	253	243	230	237	238
43	258	265	247	233	240	240
44	277	285	252	236	243	242
45	310	318	258	240	247	245
46			265	243	250	247
47			273	247	254	250
48			285	251	258	253
49			304	256	263	256
50			336	262	269	259
51				269	275	263
52				277	284	267
53				288	295	271
54				308	314	276
55				340	347	281
56						288
57						296
58						307
59						326
60						359
N	27,589	53,156	26,308	25,939	51,490	25,994
Mean	184.18	197.14	202.90	210.10	217.44	224.62
SD	24.65	27.46	22.45	26.00	24.39	24.83

Table 9. Scale Scores for Social Studies

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	33	46	56	68	72	80
1	65	78	88	100	104	111
2	84	97	107	119	123	130
3	96	109	118	130	134	141
4	104	117	127	138	142	150
5	111	124	133	145	149	156
6	117	129	139	150	154	161
7	122	134	144	155	159	166
8	127	139	148	159	163	170
9	131	142	152	163	166	174
10	134	146	156	167	170	177
11	138	149	160	170	173	181
12	141	153	163	173	176	184
13	145	156	166	176	179	186
14	148	158	169	178	181	189
15	151	161	172	181	184	192
16	153	164	174	183	186	194
17	156	166	177	186	188	196
18	159	169	180	188	191	199
19	162	171	182	190	193	201
20	164	174	184	193	195	203
21	167	176	187	195	197	205
22	169	178	189	197	199	207
23	172	181	192	199	201	209
24	175	183	194	201	203	211
25	177	185	196	203	205	213
26	180	188	199	205	207	215
27	183	190	201	207	209	217
28	185	192	203	209	210	219
29	188	195	206	211	212	221
30	191	197	208	213	214	223
31	194	199	211	216	216	224
32	197	202	213	218	218	226
33	200	204	216	220	220	228
34	203	207	218	222	222	230
35	207	209	221	224	224	232
36	211	212	224	226	225	234
37	215	215	227	229	227	236
38	219	218	230	231	229	238
39	224	221	233	233	231	240
40	230	224	236	236	233	242
41	237	228	240	238	235	244
42	245	232	244	241	238	246
43	257	236	248	244	240	249
44	276	241	253	247	242	251
45	308	246	258	250	244	253
46		253	265	254	247	256
47		261	273	257	250	258
48		272	285	262	252	261
49		291	303	266	255	264
50		323	335	272	258	267
51				278	262	271
52				286	265	274
53				298	269	279
54				316	274	283
55				348	279	289
56					286	295
57					294	303
58					305	314
59					324	333
60					355	365
N	27,333	53,109	26,156	25,891	51,425	25,905
Mean	182.54	191.93	207.14	213.92	219.73	224.80
SD	27.50	25.13	24.76	23.66	26.04	21.34

Figures 1 through 4 show the mean scale scores across grades for each subject including trend lines for one standard deviation above and below the mean.

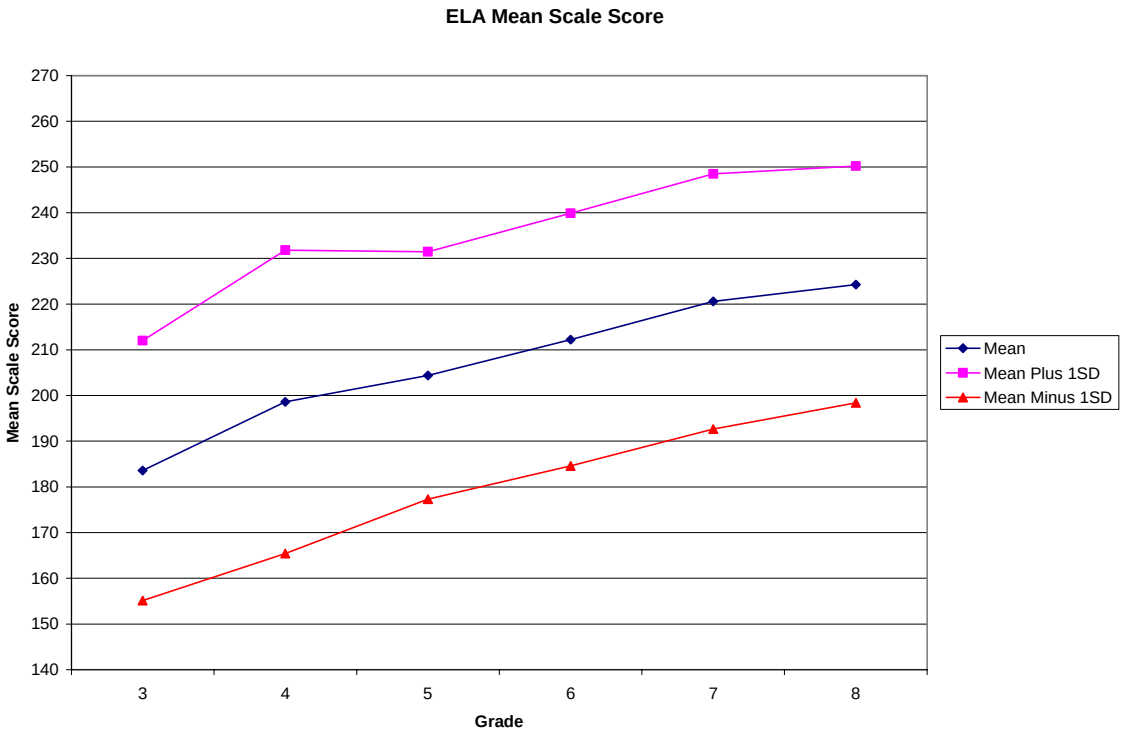

Figure 1. Mean Scale Score for ELA

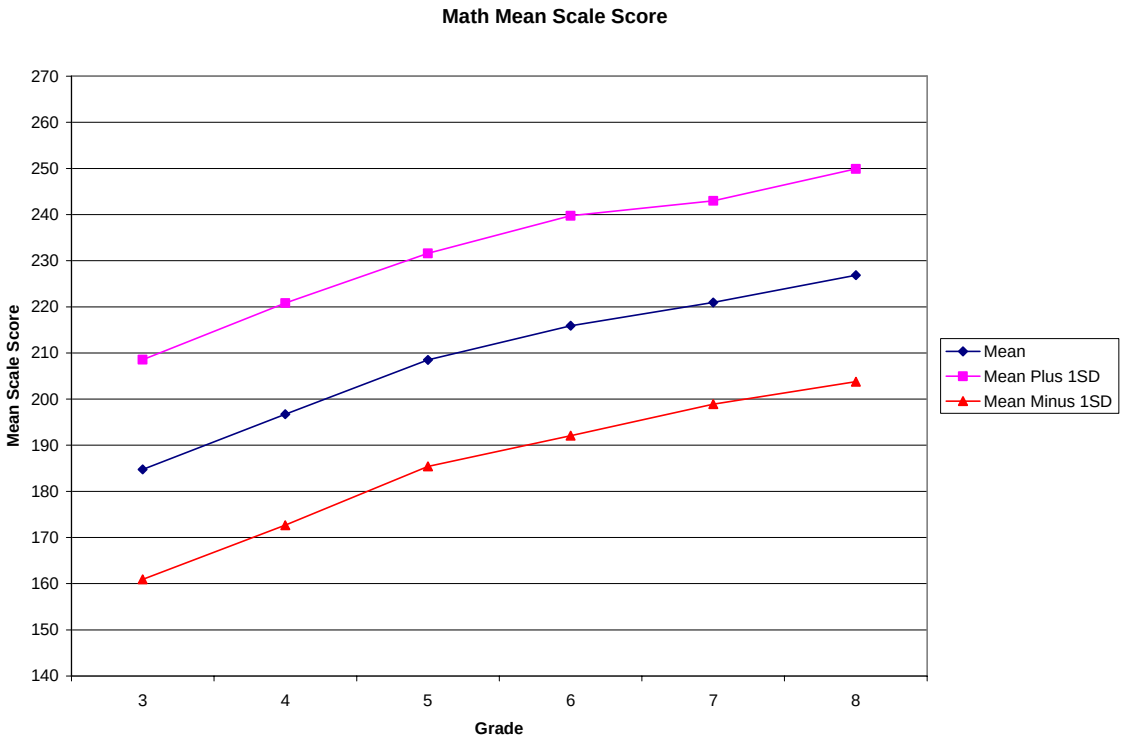

Figure 2. Mean Scale Score for Mathematics

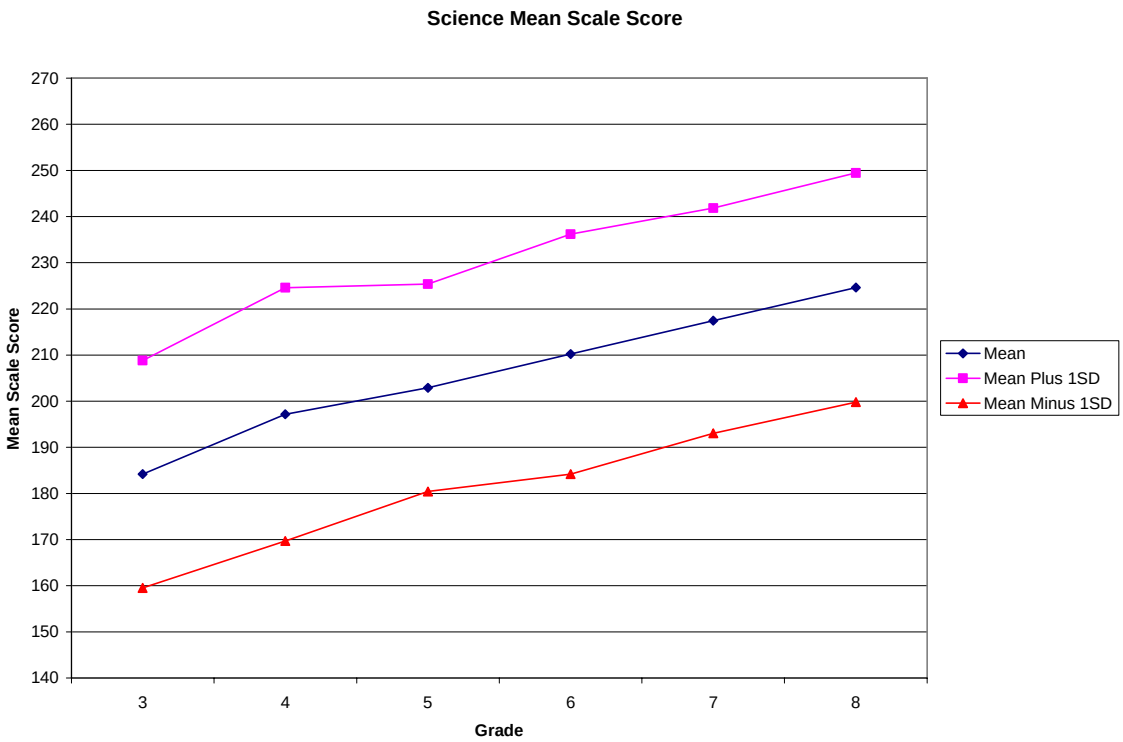

Figure 3. Mean Scale Score for Science

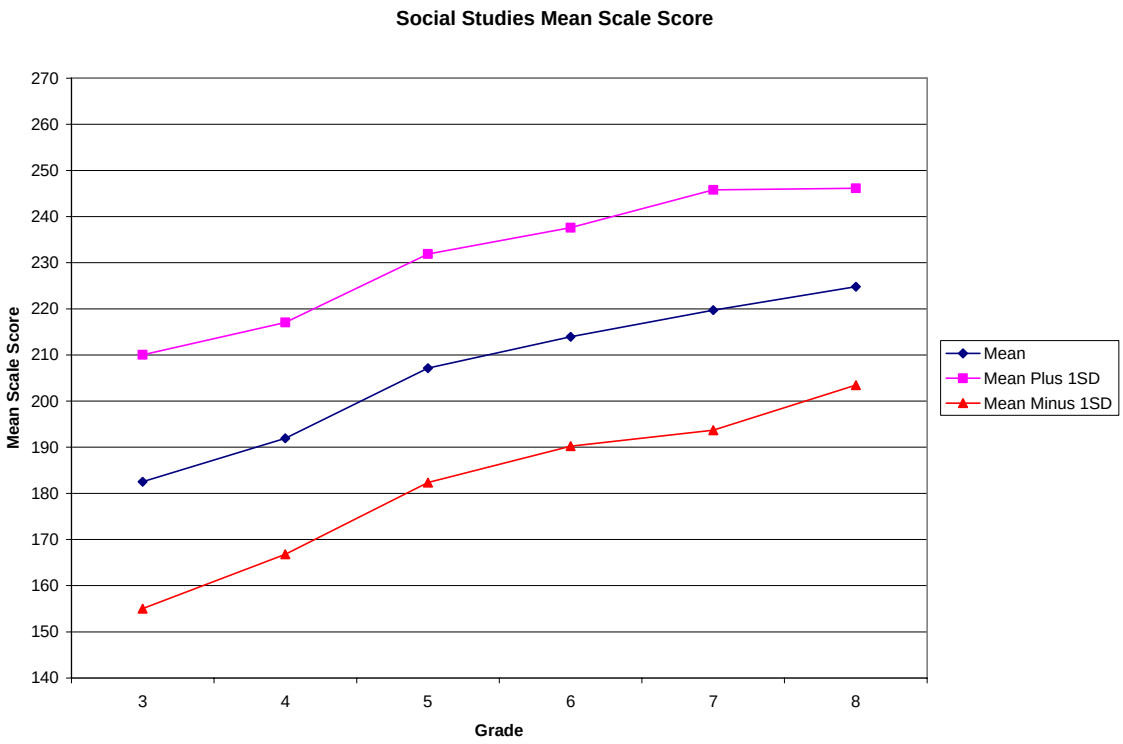

Figure 4. Mean Scale Score Social Studies

Figure 5 shows the standard deviation of scales scores for all four subjects across grades 3 through 8. This analysis shows the grade-to-grade variability for each subject.

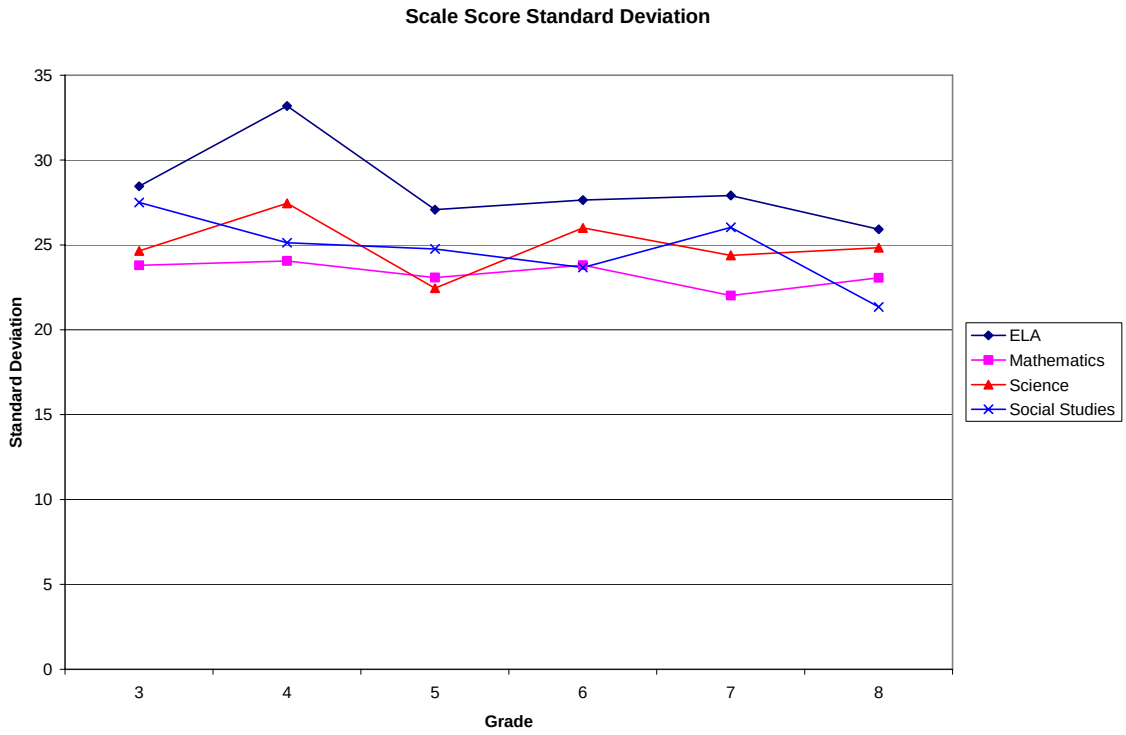

Figure 5. Scale Score Standard Deviations

Figure 6 shows the separation of grade scale score distributions as measured through an effect size index. From Kolen and Brennan (2004), this index is computed as follows:

$$es = \frac{\mu(Y)_{upper} - \mu(Y)_{lower}}{\sqrt{\sigma^2(Y)_{upper} + \sigma^2(Y)_{lower} / 2}},$$

where $\mu(Y)_{upper}$ is the mean for the upper grade group, $\mu(Y)_{lower}$ is the mean of the lower grade group, $\sigma^2(Y)_{upper}$ is the variance for the upper grade group, and $\sigma^2(Y)_{lower}$ is the variance of the lower grade group.

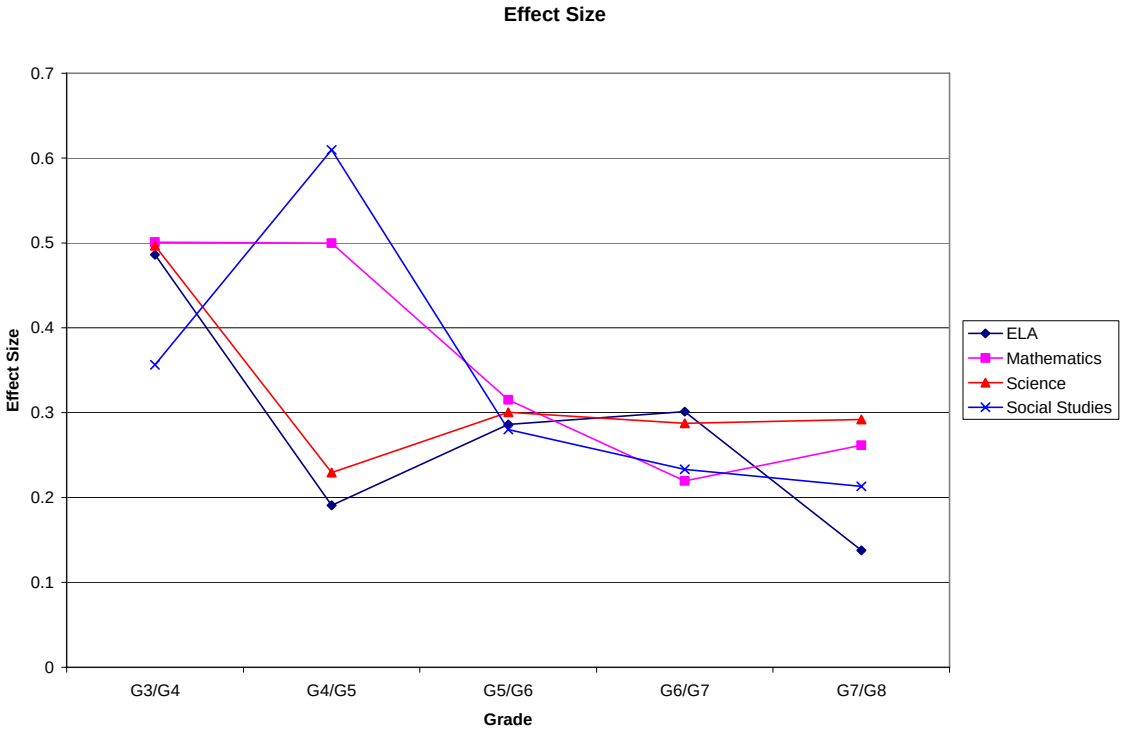

Figure 6. Effect Sizes for Grade-to-Grade Mean Scale Score Differences

Figures 7 through 10 show the median scale scores across grades for each subject including trend lines for the first and third quartiles (Q1 and Q3).

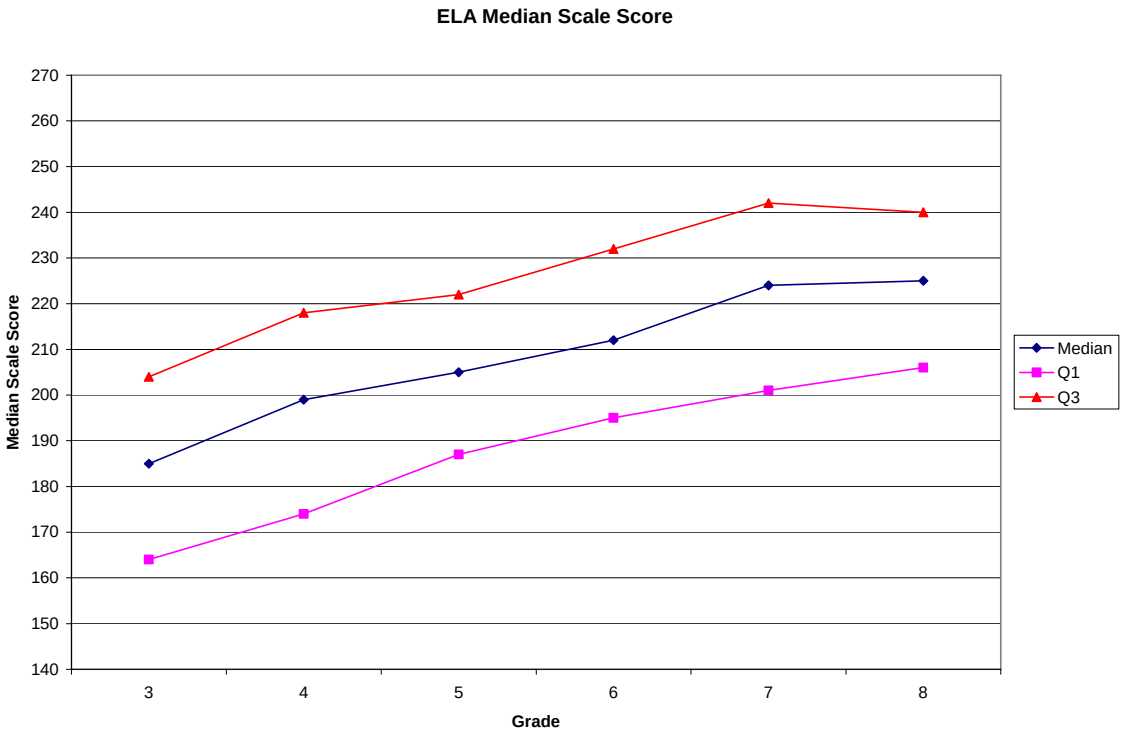

Figure 7. Median Scale Scores for ELA

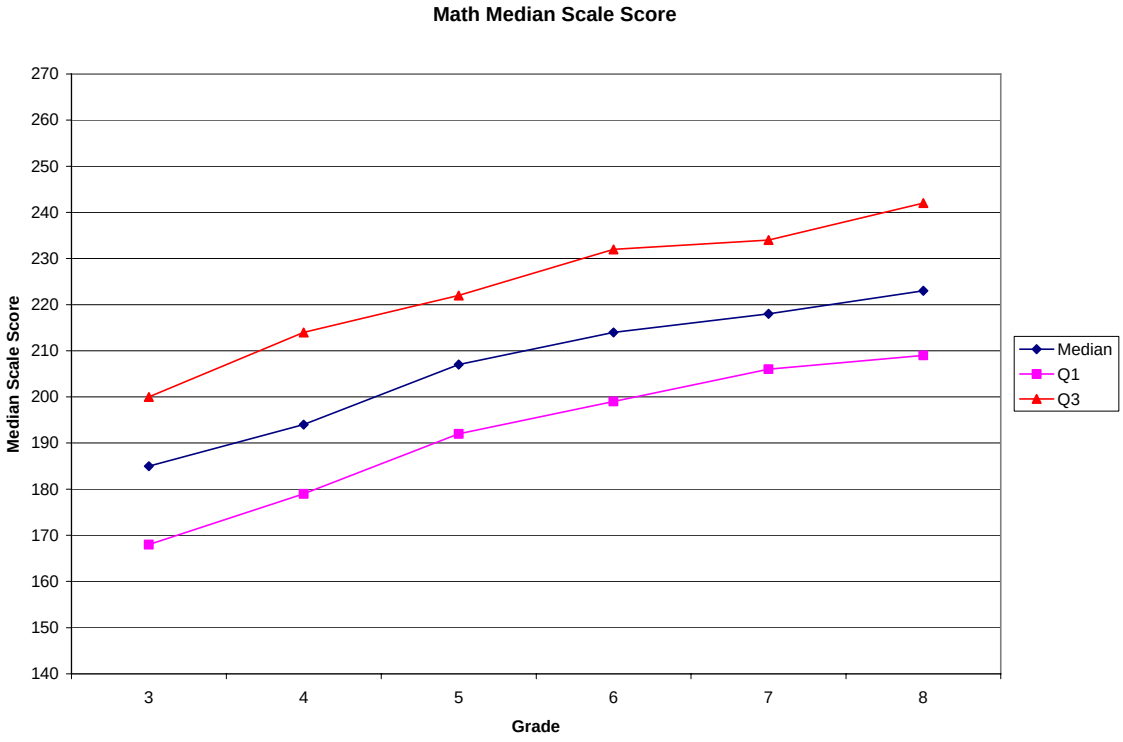

Figure 8. Median Scale Scores for Mathematics

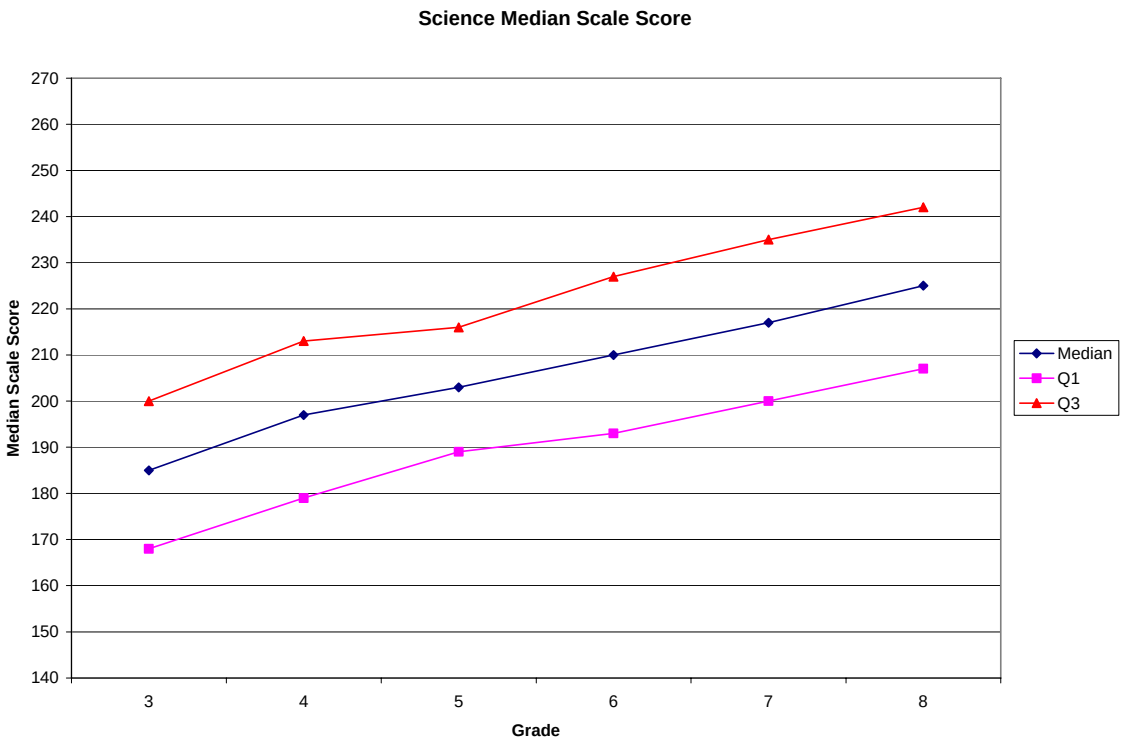

Figure 9. Median Scale Scores for Science

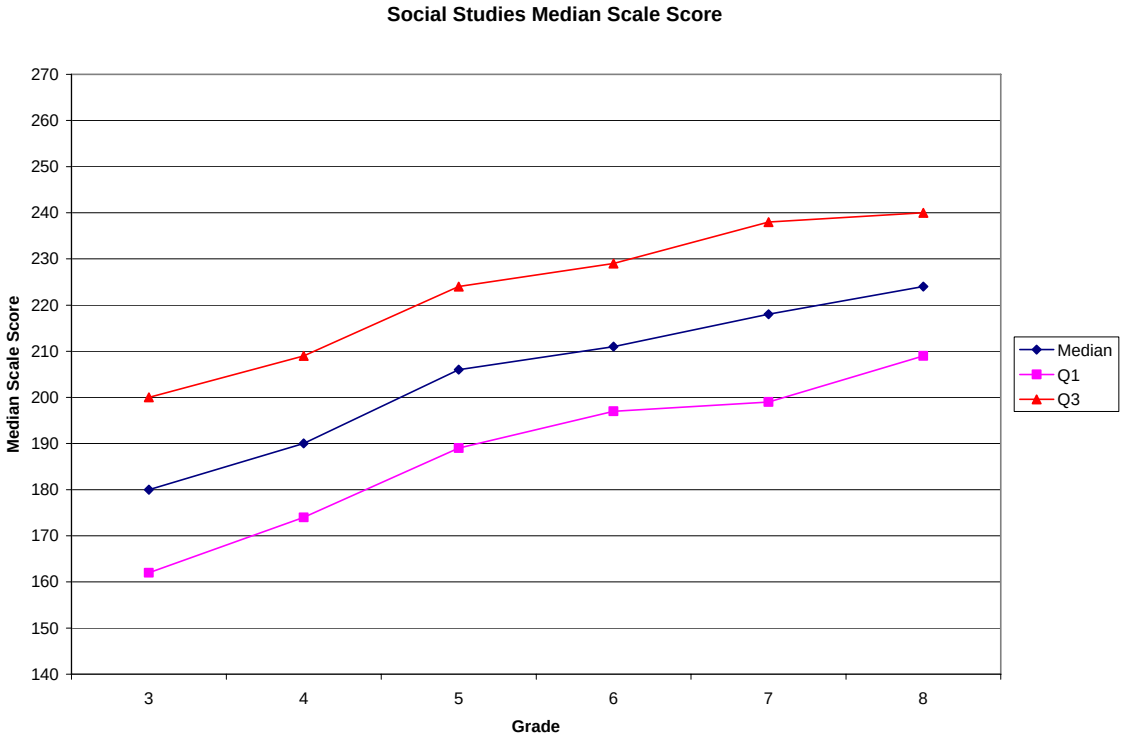

Figure 10. Median Scale Scores for Social Studies

Method #2: Fixed slope and intercept

This approach used a fixed slope of 15 and an intercept of 300 for all four subjects. Using the level linking constants described above, these values were used to obtain reportable scale scores for each subject.

Tables 10 through 13 show the scale scores for each subject for grades 3 through 8.

Table 10. Scale Scores for ELA

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	206	207	211	217	221	222
1	225	226	230	235	239	241
2	236	237	241	246	250	252
3	243	244	248	253	257	259
4	249	249	253	258	262	263
5	253	253	258	262	266	267
6	257	257	261	266	269	271
7	260	260	265	269	272	274
8	263	263	267	272	275	276
9	266	266	270	274	277	279
10	268	268	273	277	280	281
11	271	271	275	279	282	283
12	273	273	277	281	284	285
13	275	275	279	283	286	287
14	278	277	282	285	287	288
15	280	280	284	287	289	290
16	282	282	286	289	291	292
17	284	284	288	291	292	293
18	286	286	290	293	294	295
19	288	288	292	295	296	296
20	290	290	293	297	297	298
21	292	292	295	298	299	299
22	294	294	297	300	300	301
23	296	296	299	302	302	302
24	298	298	301	304	303	304
25	301	300	304	306	305	305
26	303	303	306	308	307	307
27	306	305	308	310	308	308
28	308	308	310	312	310	310
29	311	310	313	314	311	311
30	314	314	316	316	313	313
31	318	317	318	319	315	314
32	322	321	322	321	317	316
33	327	326	325	324	319	317
34	334	333	330	327	321	319
35	345	344	335	331	323	321
36	364	363	342	335	325	323
37			353	340	327	324
38			372	347	330	326
39				358	333	328
40				377	336	330
41					340	333
42					345	335
43					352	338
44					363	341
45					381	345
46						349
47						354
48						361
49						372
50						391
N	54,717	53,103	52,336	51,692	51,465	51,775
Mean	293.44	302.19	305.51	310.11	314.98	317.14
SD	16.59	19.28	15.71	16.05	16.24	15.10

Table 11. Scale Scores for Mathematics

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	198	207	149	155	229	236
1	217	225	199	203	247	255
2	228	236	237	240	258	265
3	234	243	248	251	264	272
4	239	247	254	258	269	276
5	243	251	259	263	273	280
6	246	254	263	266	276	283
7	249	257	266	270	279	286
8	252	260	269	272	281	288
9	254	262	272	275	283	290
10	256	264	274	277	285	292
11	258	266	276	279	287	294
12	260	268	278	281	289	296
13	262	270	280	283	291	298
14	264	271	282	284	292	299
15	266	273	284	286	294	301
16	267	274	285	287	295	302
17	269	276	287	289	296	303
18	270	277	288	290	298	305
19	272	279	290	292	299	306
20	273	280	291	293	300	307
21	275	281	293	294	301	308
22	276	283	294	296	303	309
23	278	284	295	297	304	311
24	279	285	297	298	305	312
25	280	287	298	299	306	313
26	282	288	299	300	307	314
27	283	289	300	302	308	315
28	285	291	302	303	309	316
29	286	292	303	304	311	317
30	287	293	304	305	312	318
31	289	294	306	306	313	319
32	290	296	307	307	314	320
33	292	297	308	308	315	321
34	294	298	309	309	316	322
35	295	300	311	311	317	323
36	297	301	312	312	318	324
37	299	302	313	313	319	325
38	300	304	315	314	321	327
39	302	305	316	315	322	328
40	304	307	318	317	323	329
41	307	308	319	318	324	330
42	309	310	321	319	325	331
43	311	312	323	320	327	332
44	314	313	324	322	328	333
45	318	315	326	323	329	335
46	322	317	328	324	331	336
47	327	320	330	326	332	337
48	333	322	332	328	334	339
49	344	324	335	329	335	340
50	363	327	338	331	337	342
51		331	341	333	339	343
52		334	345	335	341	345
53		339	350	337	343	347
54		346	356	339	346	349
55		357	367	342	348	351
56		375	385	345	351	353
57				349	355	356
58				354	360	359
59				360	366	363
60				371	377	367
61				389	395	374
62						385
63						403
N	54,776	53,161	52,318	51,671	51,523	51,837
Mean	291.79	300.05	308.22	313.31	316.78	320.89
SD	16.43	16.632	16.00	16.46	15.20	15.91

Table 12. Scale Scores for Science

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	203	209	217	217	223	227
1	222	227	236	236	241	246
2	233	238	247	247	252	256
3	240	245	253	253	258	263
4	245	250	258	258	263	268
5	249	254	262	262	267	271
6	253	257	265	265	270	274
7	256	260	268	268	273	277
8	258	263	271	270	275	279
9	261	265	273	273	278	282
10	263	267	275	275	280	284
11	265	269	277	277	281	285
12	267	271	279	279	283	287
13	269	273	281	280	285	289
14	271	275	282	282	287	290
15	273	276	284	283	288	292
16	275	278	286	285	290	293
17	276	280	287	286	291	295
18	278	281	289	288	292	296
19	280	283	290	289	294	297
20	281	284	292	291	295	298
21	283	286	293	292	296	300
22	284	288	294	293	298	301
23	286	289	296	294	299	302
24	287	291	297	296	300	303
25	289	292	299	297	301	304
26	291	294	300	298	302	305
27	292	295	301	299	304	306
28	294	297	303	301	305	308
29	295	299	304	302	306	309
30	297	300	306	303	307	310
31	299	302	307	304	308	311
32	300	304	308	305	310	312
33	302	306	310	307	311	313
34	304	308	311	308	312	314
35	306	310	313	309	313	315
36	308	312	315	311	315	316
37	311	315	316	312	316	318
38	313	317	318	313	317	319
39	316	320	320	315	319	320
40	320	324	322	316	320	321
41	323	328	324	318	322	322
42	328	333	326	319	323	324
43	335	339	329	321	325	325
44	346	350	332	323	327	326
45	364	369	335	325	329	328
46			339	327	331	329
47			344	329	333	331
48			350	331	335	332
49			361	334	338	334
50			380	337	341	336
51				341	345	338
52				346	350	340
53				352	356	342
54				363	367	345
55				382	385	348
56						352
57						357
58						363
59						374
60						392
N	27,589	53,156	26,308	25,939	51,490	25,994
Mean	293.33	300.68	303.95	308.10	312.22	316.30

SD	13.92	15.54	12.71	14.73	13.82	14.04

Table 13. Scale Scores for Social Studies

Raw Score	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
0	204	212	217	224	226	231
1	222	230	235	243	245	249
2	233	241	246	253	255	260
3	240	247	253	260	262	266
4	245	252	258	264	267	271
5	249	256	262	268	270	275
6	252	259	265	271	273	278
7	255	262	268	274	276	280
8	258	265	270	276	278	283
9	260	267	273	279	281	285
10	262	269	275	281	282	287
11	264	271	277	282	284	289
12	266	273	278	284	286	290
13	268	274	280	286	288	292
14	270	276	282	287	289	294
15	271	278	284	289	291	295
16	273	279	285	290	292	296
17	275	281	287	292	293	298
18	276	282	288	293	295	299
19	278	283	290	294	296	300
20	279	285	291	296	297	302
21	281	286	292	297	298	303
22	282	287	294	298	299	304
23	284	289	295	299	300	305
24	285	290	296	301	302	306
25	287	291	298	302	303	307
26	288	293	299	303	304	308
27	290	294	300	304	305	310
28	291	295	302	305	306	311
29	293	297	303	306	307	312
30	295	298	305	308	308	313
31	296	299	306	309	309	314
32	298	301	307	310	310	315
33	300	302	309	311	311	316
34	302	304	310	312	312	317
35	304	305	312	314	313	318
36	306	307	313	315	314	319
37	308	308	315	316	316	321
38	311	310	317	318	317	322
39	314	312	319	319	318	323
40	317	314	321	320	319	324
41	321	316	323	322	320	325
42	326	318	325	323	321	327
43	332	321	327	325	323	328
44	343	323	330	327	324	329
45	362	326	333	329	325	331
46		330	337	331	327	332
47		335	342	333	328	333
48		341	349	335	330	335
49		352	359	338	332	337
50		371	378	341	333	339
51				345	335	341
52				349	337	343
53				356	340	345
54				367	342	348
55				385	346	351
56					349	354
57					354	359
58					360	366
59					371	376
60					389	395
N	27,333	53,109	26,156	25,891	51,425	25,905
Mean	289.79	295.23	303.91	307.89	311.22	314.14

SD	15.79	14.42	14.22	13.57	15.00	12.28

Figures 11 through 14 show the mean scale scores across grades for each subject including trend lines for one standard deviation above and below the mean.

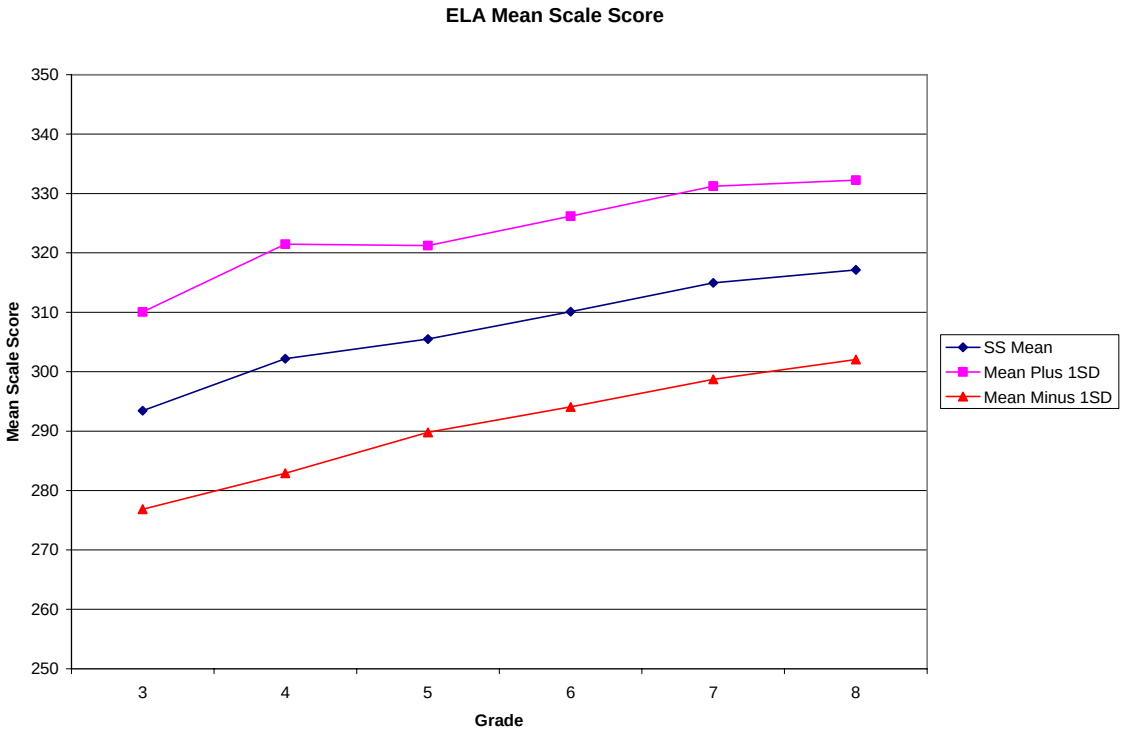

Figure 11. Mean Scale Scores for ELA

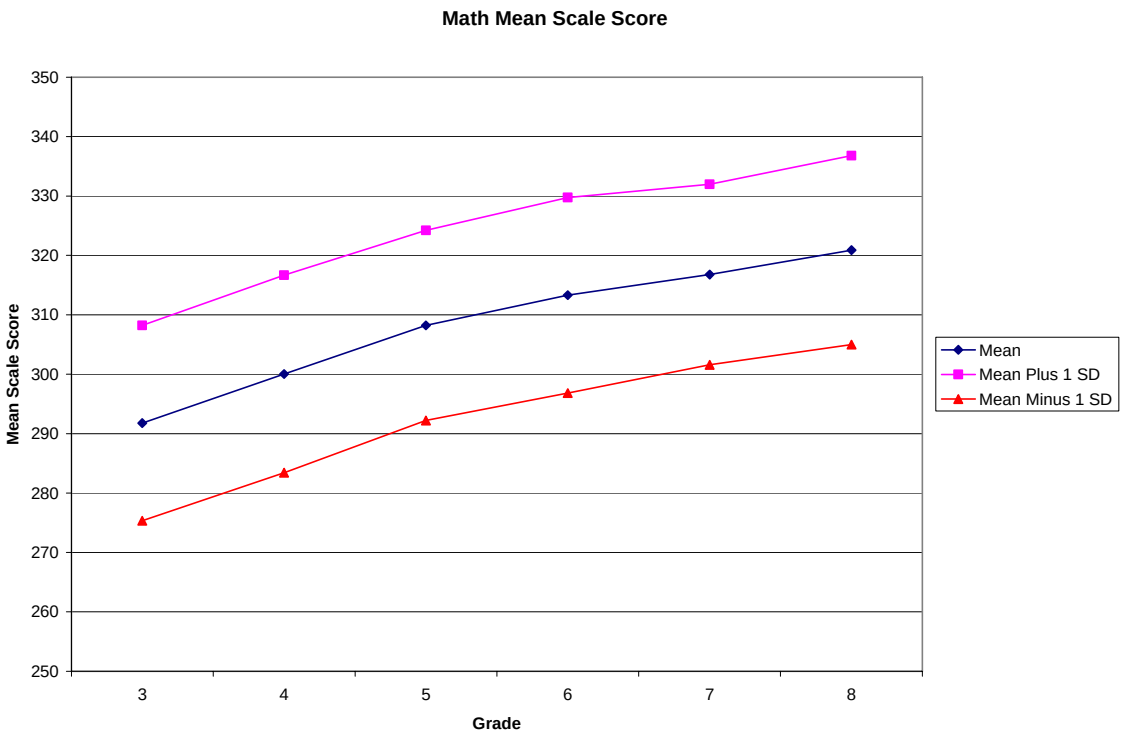

Figure 12. Mean Scale Scores for Mathematics

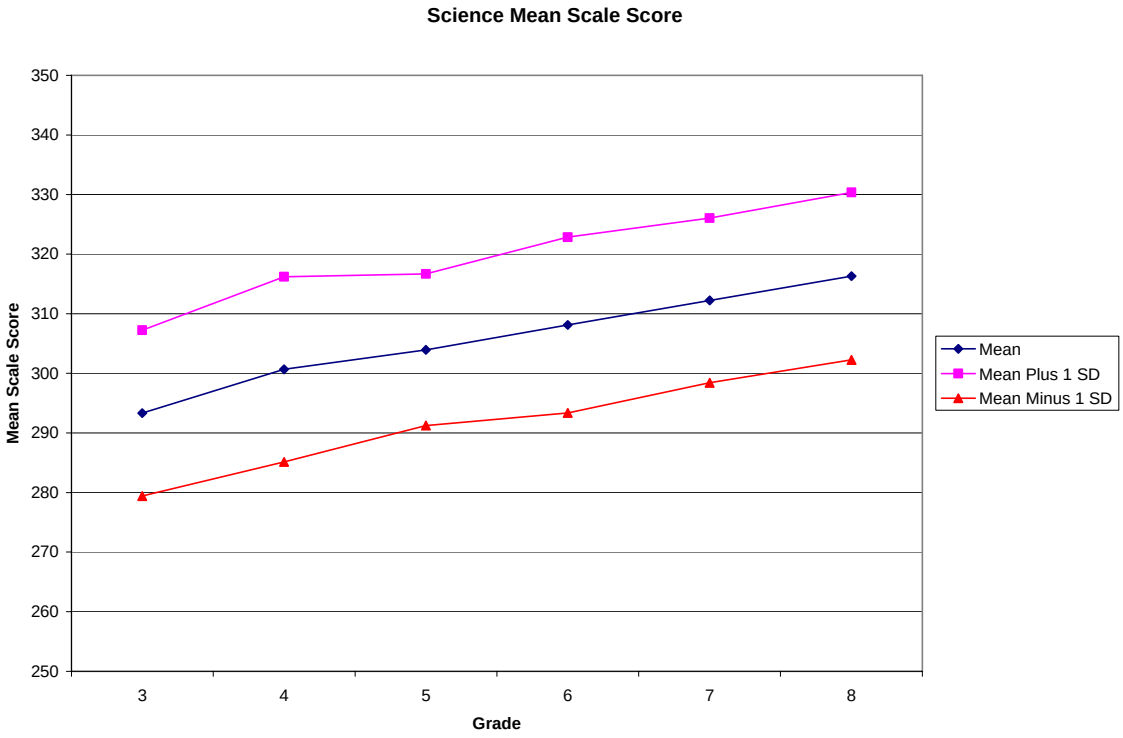

Figure 13. Mean Scale Scores for Science

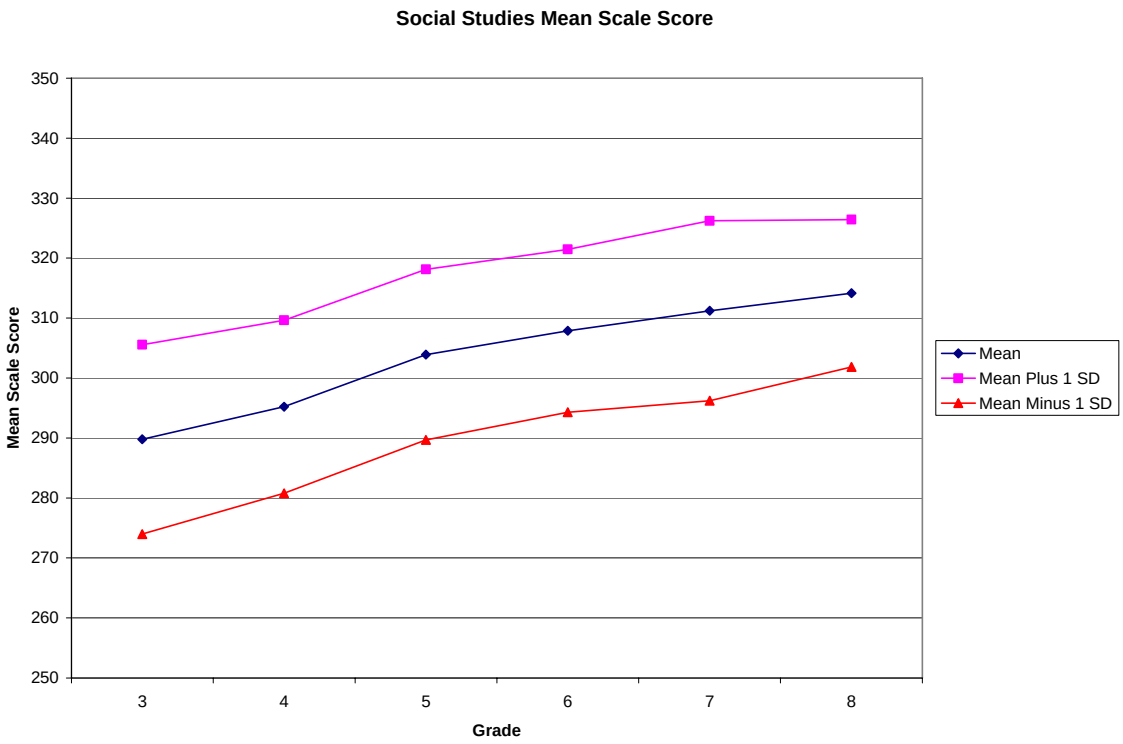

Figure 14. Mean Scale Scores for Social Studies

Figure 15 shows the standard deviation of scales scores for all four subjects across grades 3 through 8. This analysis shows the grade-to-grade variability for each subject.

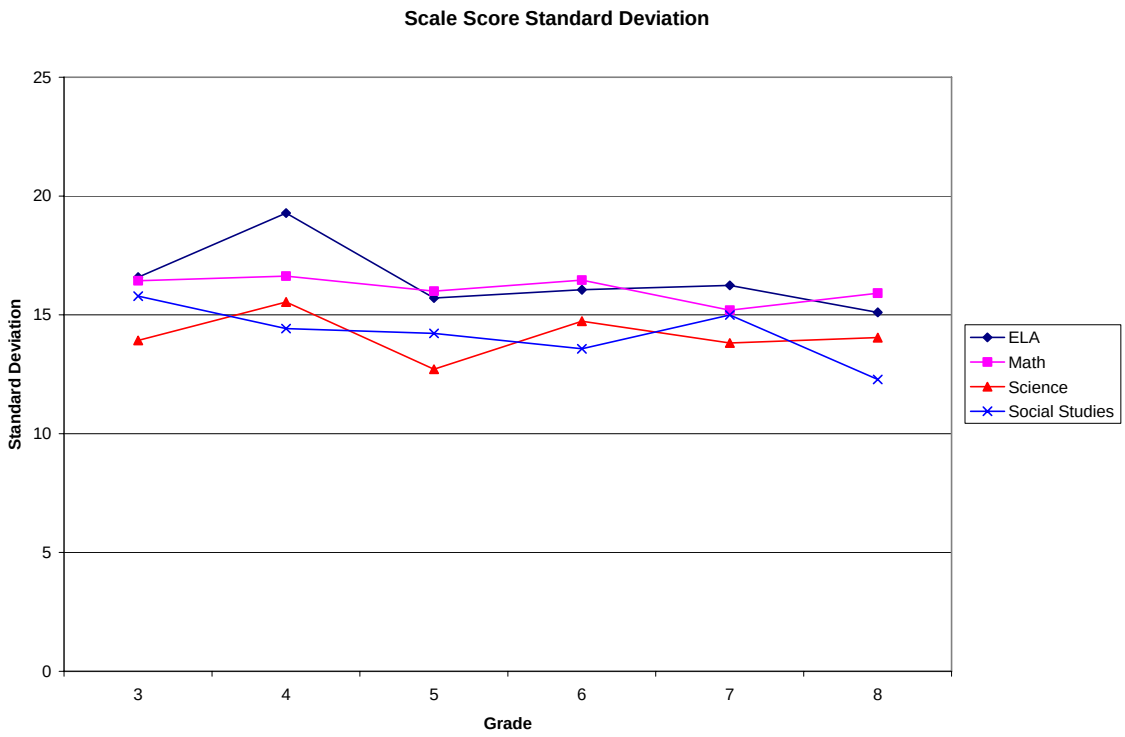

Figure 15. Scale Score Standard Deviations

It is important to note that the location of standard deviations for Mathematics under this method is higher than that found in the first method.

Figure 16 shows the separation of grade scale score distributions as measured through an effect size index. This index is computed using the same formula as was used for the results from the first method of creating a vertical scale.

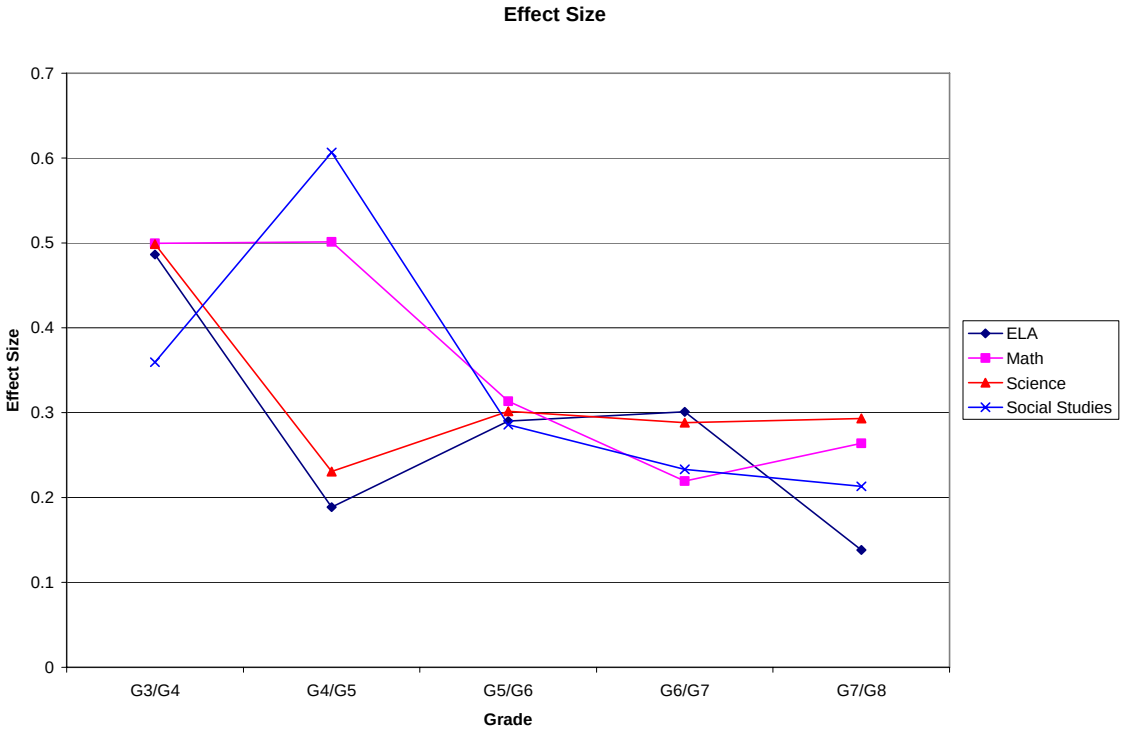

Figure 16. Effect Sizes for Grade-to-Grade Mean Scale Score Differences

Figures 17 through 20 show the median scale scores across grades for each subject including trend lines for the first and third quartiles (Q1 and Q3).

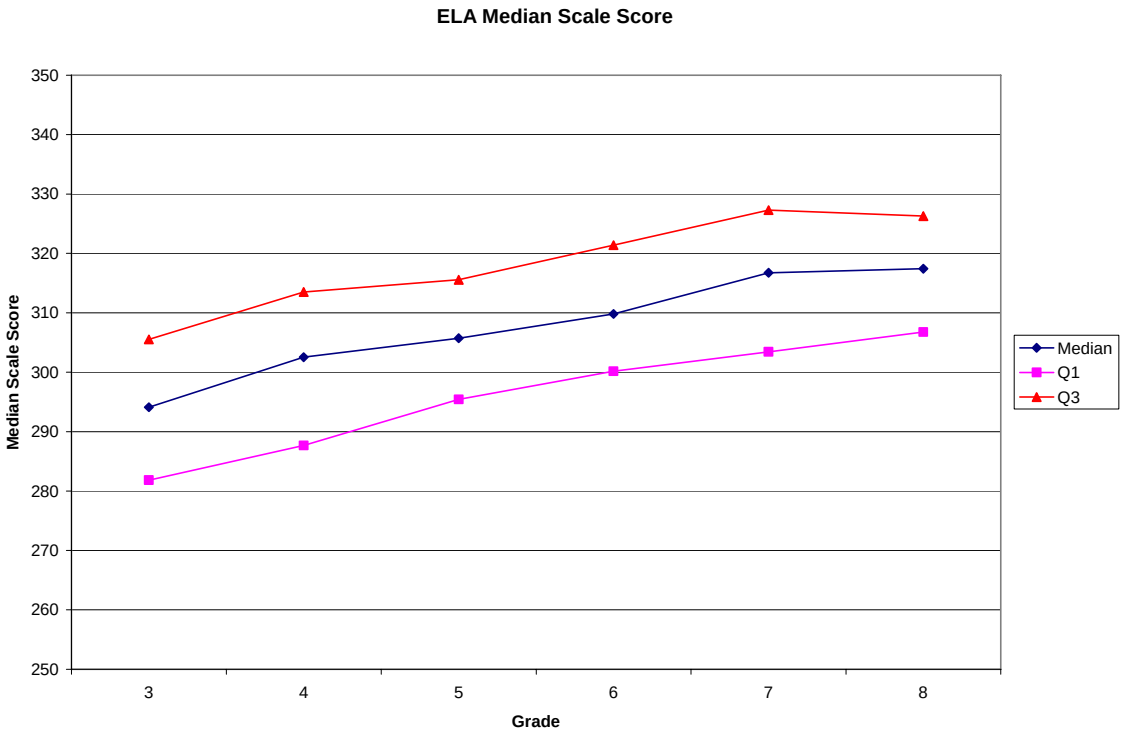

Figure 17. Median Scale Scores for ELA

Figure 18. Median Scale Scores for Mathematics

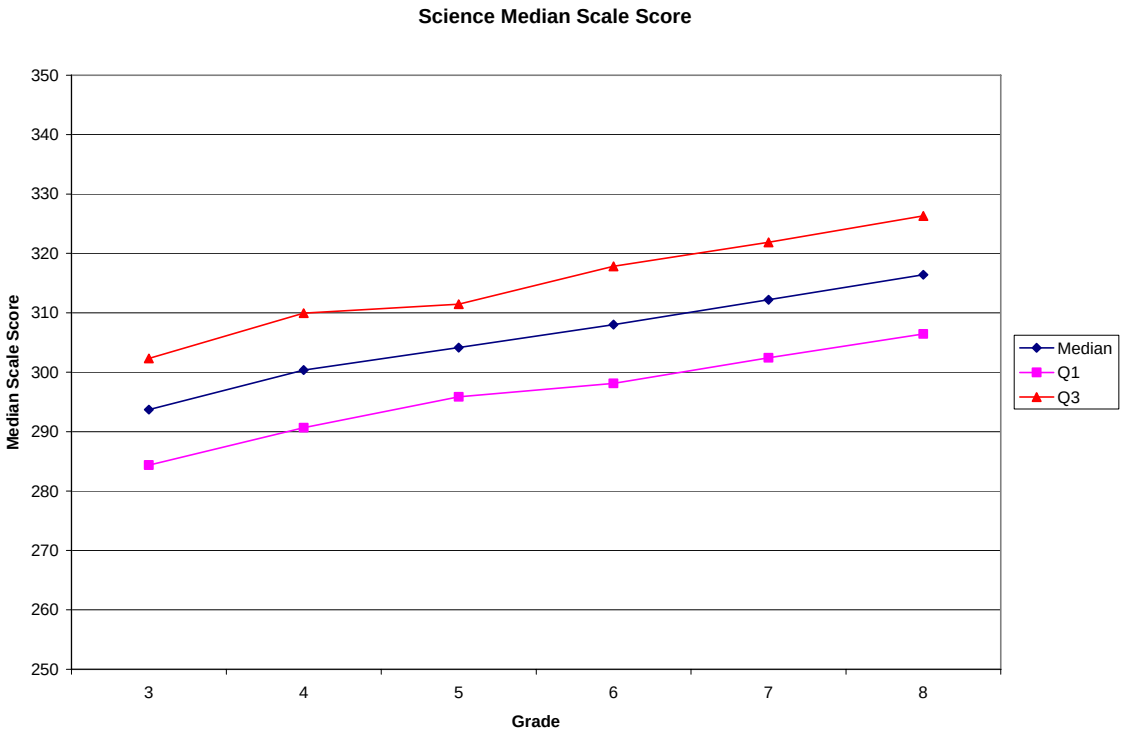

Figure 19. Median Scale Scores for Science

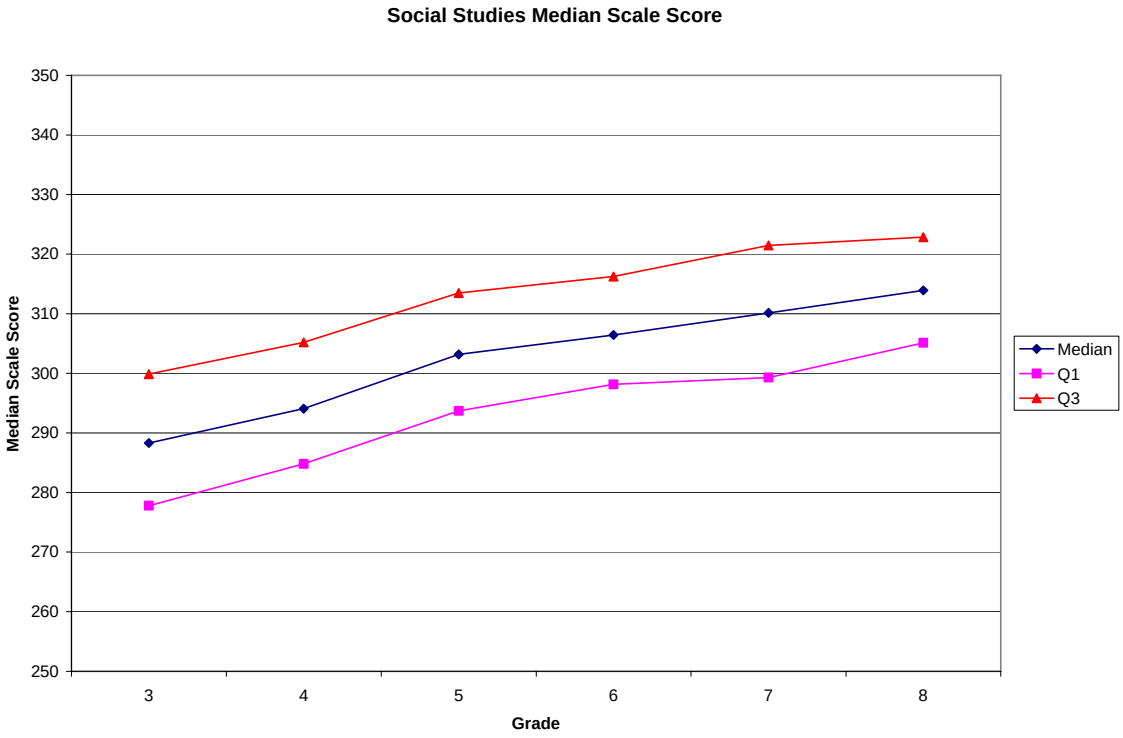

Figure 20. Median Scale Scores for Social Studies

Conclusion

This report presents two approaches of creating vertical scales, using the Spring 2009 PASS operational data, which mostly yielded similar results in terms of scale score trends across grades. However, the location of standard deviations for Mathematics was different between the two vertical scaling approaches. The first method showed the standard deviations to be mainly below the other three subjects, while the second method resulted in standard deviations near or at the highest standard deviations achieved across the subjects. It was found, though, that the *raw score* standard deviations across grades, for Mathematics, were the lowest among the subjects.

As was mentioned earlier, a limitation of using the Kolen and Brennan approach for determining a vertical scale for the PASS subjects was the range of theta estimates obtained through Rasch calibration. *Originally*, this study was to anchor the grade 8 mean scale score at 850 and a grade 3 mean scale score at 350, which has been accepted in practice of creating a vertical scale from grade 3 to grade 8. However, due to the extreme low theta estimates, using these mean scale scores in computing the slopes and intercepts resulted in scale scores that are not interpretable (e.g., negative scale scores as well as extremely high scale scores). Therefore, the desired mean scale scores had to be chosen in a way that allowed for appropriate scale scores to be generated. This is the reasoning behind using a modified strategy of the Kolen and Brennan approach.

The most difficult part of creating a vertical scale was choosing desired scale score means that 1) would allow for appropriate (i.e., non-negative) scale scores and 2) make sense for the assessment program (i.e., appropriate room for "growth" across grades). Despite the "growth" that was shown through the increasing mean and median scale scores for all subjects across grades (and vertical scaling approaches), some caution should be used with these results. Based on the information from Table 1, there were several vertical linking items that performed better at the lower grade than at the higher grade, yet they were not excluded from the calculations of the vertical linking constants. This was due to the fact the Robust Z statistics for these items were lower than 1.645. The number of these instances across the grades and subjects may cause some concern for adopting a vertical scale. Also, both vertical scaling approaches resulted in maximum scale scores for ELA grade 4 that were higher than the maximum scale score for grade 3. These findings may introduce caveats of adopting a vertical scale.

References

Kolen, M. J. & Brennan, R. L., (2004). *Test equating, scaling, and linking: Methods and practices* (2nd ed.). New York: Springer-Verlag.

Young, M. J. (2006). Vertical scaling. In S. M. Downing and T. M. Haladyna (Eds.), *Handbook of test development*. Mahwah, NJ: Lawrence Erlbaum Associates.